

PROCEEDINGS

OF THE

Hawaiian Entomological Society

Vol. III, No. 4.

FOR THE YEAR 1916.

MAY, 1917.

JANUARY 6TH, 1916.

The one hundred twenty-fourth meeting of the Society was held in the usual place, President Illingworth in the chair. Other members present: Messrs. Bridwell, Bryan, Ehrhorn, Mant, Pemberton, and Swezey.

Minutes of previous meeting read and approved.

NOTES AND EXHIBITIONS.

Mr. Bridwell exhibited specimens and related interesting observations made on a number of rare, strange, beautiful, or otherwise interesting insects from Australia and Africa:

Stigmodera.—A box of specimens exhibited, containing many species of this Buprestid genus. About 300 species of the genus are known in Australia, of great variety as regards size, coloration, etc. About 70 species are found in the vicinity of Sydney, being usually taken on flowers, particularly *Leptospermum* and *Angophora*. The genus is under revision by Mr. H. J. Carter of Sydney and will be split up, several sections deserving separation. Five species of the characteristic African genus *Julodis* and a specimen of *Cyria imperialis* from Sydney where it is commonly found on the foliage of *Banksia*.

Psychopsis newmani.—A bred specimen of this rare moth-like Neuropteran was exhibited. *Psychopsis* has been included in the Hemerobiidae, but Mr. R. J. Tillyard of Sydney, whose remarkable work in Neuroptera and Odonata is clearing up the affinities of many of the groups, considers the genus as forming a distinct archaic family. He has been the first to

study its life-history and to trace the development of its venation.

Thynnidae.—He exhibited a box of Australian *Thynnidae* collected in the Moreton Bay district of Queensland and near Sydney.

Rophalomutilla clavicornis.—A Mutillid, so determined by Dr. L. Peringuey of the South African Museum, was taken while visiting glands on the foliage of a malvaceous weed at Oloke Meji, Nigeria. The male carries the female in copula much as do the male *Thynnidae*.

Synagris cornuta.—A pair of this large Eumenid wasp and three of its mud nests were exhibited.

Chitinization.—Mr. Bridwell made some remarks on the chitinization of bees and flies, to the effect that it does not take place fully in many cases until the recently emerged adult has fed. In many other cases chitinization is completed without feeding.

Chinese Thrush.—Prof. Bryan announced the death of the Chinese thrush which he had had in a cage since last May, experimenting on its food habits, it having been captured in a rat trap. It would not eat papaia or figs, nor oranges except when they were cut open. It ate any kind of insect which was offered it, also centipedes and scorpions, but would not eat wood-lice. It was fond of the common garden snail, but did not eat the native snail from the mountains even when broken open for it. As a regulation ration it took a preparation made by mixing raw eggs with puffed rice and drying it. These feeding experiments indicate that the bird is insectivorous and therefore to be considered as beneficial.

Cephalonomia sp.—Mr. Swezey reported finding this Bethyloid, Jan. 4th, in a package of seeded Muscatel raisins, where it was breeding on the larvae of *Silvanus surinamensis*. A male and female were found, and 23 cocoons on the surface of the raisins where the host larvae had been feeding. Two larvae were also found on their respective host larvae. The cocoons were retained to obtain a further supply of specimens of the parasite. A related insect, *Neoscleroderma (Ateleopterus) tarsalis* Ashm., was reported by Ashmead similarly breeding on the same host in raisins.

Notes on *Synagris*.

BY J. C. BRIDWELL.

The genus *Synagris* is a characteristic Ethiopian genus of wasps of which three species were taken at Oloke Meji, Nigeria (*S. cornuta* Linne, *S. sicheliana* Saussure and *S. amplissima* Kohl).

Of these the most abundant was *S. cornuta*. This species and *S. sicheliana* were commonly found visiting the large pea-like flowers of a species of *Crotalaria*, their long tongues enabling them to secure the nectar concealed within.

The male of *S. cornuta* is remarkable for the peculiar antler-like process developed on the base of the mandibles and projecting forward about four times the length of the mandible. In some individuals this is much more feebly developed and less than twice the length of the mandible and in others still it is represented only by a tubercle. In *S. amplissima* the male typically bears a pair of long projecting horns on the posterior margin of the second sternite, absent however in some individuals. Peculiar male secondary sexual characters abound in the genus and are frequently absent in individual males.

The females of the genus have great powers of stinging and are not at all loath to employ them. The males share with the males of *Monobia quadridens* of North America the unusual power of inflicting a real sting, the male genitalia terminating in sharp slender spines capable of piercing the human skin and producing a distinct painful sting.

The nests are made of mud-cells arranged in a single layer on the underside of green leaves or in sheltered positions on large stones. One nest was made up of five cells. The cells are not closed until the larva is full grown and ready to pupate. Since none of the cells examined contained insect remains the larvae are apparently fed by the mother either on insect juices or possibly on nectar.

A Note on an *Epyris* and Its Prey.

BY J. C. BRIDWELL.

Haliday in 1834 reported an unknown *Bethylus* dragging about a lepidopterous larva with the apparent purpose of burying it. This observation has been looked on with a certain amount of suspicion particularly since the general parasitic habit of the Bethyridae has been recognized. He considered it as showing the fossorial relations of the Bethylids. I am happy to be able to add a second case to his and cite analogous cases among the Scoliidae, the closest allies of the Bethyridae, and with similar parasitic-predaceous habits.

In April, 1915, while collecting on the golf links of the Mowbray Golf Club on the sand flats east of Capetown, I observed a small black Hymenopteron dragging along between its jaws a small tenebrionid larva which was, however, several times larger than its captor. After watching it for a moment I captured it and its prey and mounted them together. Upon examination the wasp proved to be a species of *Epyris* apparently as yet undescribed.

In most cases I think the Bethylids find their prey in suitable locations, sting them and oviposit in them; and only in exceptional cases attempt to place them more suitably and this seems also to be the case with the Scoliidae. This would explain the rarity of such observations.

In 1859 Philip Henry Gosse published a little book called "Letters from Alabama (U. S.) Chiefly Relating to Natural History," which contains a number of original observations on our insects which have escaped the cataloguers. On pp. 120 and 121 will be found the following passage reproduced here on account of the scarcity of the book from which it is drawn and as showing such an exceptional case among the Scoliids.

"There is a hymenopterous fly (*Scolia quadrimaculata*) which I have seen here occasionally, in the paths of the forest, towards evening. It is shaped like a bee, but is vastly larger, deep black, with four large yellow spots on the abdomen,

placed in the form of a square; the wings have in a high degree that brilliant violet reflection which is found in many species of this order; the legs are thickly clothed with coarse black hair. The first time I saw it, it was fluttering along the ground, half flying, half crawling, carrying the larva of a lamellicorn beetle in its mouth, as big and as long as my little finger, indeed much larger and heavier than itself; I was told that it is in the habit of burying these in the ground. Doubtless, like many other similar insects, it stupefies the larva, without killing it, and then lays its egg in the hole with it, so that the young, as soon as hatched, finds its food thus ready prepared for it. The insect is somewhat clumsy in its motions, even when unincumbered; sometimes fluttering along the ground, thus, a few inches at a time, so slowly as to be readily caught, at other times flying fairly enough, but with a heavy, lumbering flight. I do not believe that it is poisonous or if it is, that it readily exerts its powers."

It is probably only exceptionally that the *Scolia* (better known in our lists as an *Elis*) would have occasion to bury its prey or to transfer it from place to place.

Forbes has reported *Tiphia* burying exposed *Lachnosterna* larva (Illinois Expt. Sta. Bull. 118, and 24th Rept. Ill. State Ent., p. 159, 1908).

Notes on the Thynnidae.

BY J. C. BRIDWELL.

The Thynnidae are a family of Scolioid wasps presenting several points of great interest. They combine extreme specialization due to parasitic habits with archaic characters retained in but few Aculeate Hymenoptera. The incomplete fusion of the thorax in both sexes with the pronotum and propodeum movable upon the mesonotum and metanotum, is a character of extreme interest and so far as I can learn found in no other Aculeates. In many of the species the first cubital cell is distinctly divided so as to form four closed cubital cells. Both these characters seem to me extremely archaic. The males have exceptionally strong powers of flight while the

females are wingless and in many cases have the mouth parts besides the mandibles largely atrophied.

The family is one of those whose distribution is of great interest and is a southern group. If we exclude *Methoca*, whose association with the family must be considered doubtful, the Thynnidae are represented in the northern hemisphere by two or three species from California and a single species is found in the Galapagos Islands. There have been no species as yet described from Africa tho in Capetown Dr. Peringuey showed me an authentic male Thynnid from South Africa. In South America, Chile, Argentine, and Southern Brazil, the family is abundantly represented. About 400 species are known from Australia, Papua and the adjacent island groups, being much more numerous represented in Southern Australia among the characteristic Australian fauna and flora than in the north, where the Malayan element is more abundant.

In Australia it is the dominant family among the Forsorial Hymenoptera, appearing more numerous in species and individuals than any other group.

Most of the species frequent flowers, particularly the Myrtaceous *Angophora* and *Leptospermum*.

Mr. Henry Hacker, the indefatigable entomologist of the Queensland Museum, guided the writer to his favorite collecting grounds around Brisbane and on Stradbroke Island in Moreton Bay, and kindly told him many interesting observations which he had made and enabled him to see for himself their behavior in the field.

The Thynnidae, according to Mr. Hacker's observations, are certainly subterranean in their breeding habits, for the females frequently come up out of the ground covered with mud. Like most Hymenoptera the males emerge first, in most species appearing in September and October, feeding at flowers and racing up and down footpaths in the forests and among bushes searching for the females. These when they emerge crawl up to the top of the grass, weeds or bushes and await the males there. When a male discovers a female he swoops

down on her and according to Mr. Hacker's observations the female grasps him with her mandibles by the end of the abdomen or legs and accouplement is effected while in flight. The coupled pair visits flowers and apparently the male, in some cases at least, feeds the female.

No reliable observations appear to have been published in regard to the breeding habits of any of the species, tho one published note credits one species with dragging a cricket about. This, however, appears to be a mistake. Mr. Rowland E. Turner, who has monographed the species and has collected them extensively, suggests that they may be parasitic on other Aculeate Hymenoptera after the manner of the Mutillidae. It would, however, be difficult to find Aculeates enough of the size necessary to provide food for the numerous species of the size of *Thynnus apterus* and abundant enough to account for the great numbers of them which are to be found. The great number of species to be found in a locality greater than the number of abundant species of Aculeates appears also to negative this view. To the writer it seems more likely that the larvae of Scarabaeid and Rhyncophorous beetles furnish them with prey. The larvae of both groups are nearly enough alike to serve as the prey of such a compact group where we would expect community of habits. If the group has community of habits there is no other source for prey for the group than the grubs of these beetles, which are largely subterranean, numerous enough in species and in individuals, and with differences enough in size to provide for all the species of Thynnidae. The affinities of the Thynnidae are also with the Scoliid wasps such as *Plesia* and *Myzine* which attack *Scarabaeidae* rather than with the Mutillidae with their usual habits of parasitism on other Hymenoptera.

We await with great interest a series of life-history studies in this group from some of our capable Australian entomologists.

Regeneration in Cockroaches.

BY J. F. ILLINGWORTH.

While carrying on life history work with our Hawaiian cockroaches I was interested in noting the rapid replacement of lost appendages, etc. Eight of our species have been observed.

Usually, if a leg is broken off beyond the trochanter, soon after molting, the appendage is renewed at the next molt, which occurs in a month or six weeks. If the injury happens shortly before molting the parts are not renewed until the succeeding molt.

In catching roaches they often lose some parts of the legs and it was observed that these appendages never break off above the trochanter. Experiments were tried of cutting off the trochanter and in some cases the entire leg, next to the body. In each case, where the victim survived, the wound soon scarred over and became heavily chitinized, but regeneration. Apparently the renewing cells are located in the proximal segments of the leg.

The antennae, also, have the power of renewing, even when cut off close to the head. At the first molt only a few segments appear, but if molting continues they are soon of their normal length.

It is interesting to note that when the tarsi are renewed, they lack the fourth segment, in every case observed. This apparently accounts for many roaches having only four tarsal segments on part of the legs.

FEBRUARY 3RD, 1916.

The one hundred twenty-fifth meeting of the Society was held in the usual place, President Illingworth in the chair. Other members present: Messrs. Back, Bridwell, Ehrhorn, Giffard, Kuhns, Pemberton, and Swezey and Mr. P. H. Timberlake, visitor.

Minutes of previous meeting read and approved.

Mr. Swezey proposed the name of Mr. P. H. Timberlake for active membership in the Society.

NOTES AND EXHIBITIONS.

Halobates sp.—Mr. Pemberton reported finding this bug in hundreds at Waikiki beach, January 19th. It was during a "Kona" storm. They were in foot-prints in the sand. None were to be found the following day.

Lucilia dux.—Mr. Kuhns exhibited specimens of this fly reared from maggots found floating in large numbers on the surface of the water of Pearl Harbor, January 16th. He inferred that they must have been washed in from some dead animal on the beach. There had been much rain and high water which would have made this possible.

Chrysopa microphya.—Mr. Ehrhorn exhibited a cocoon of this lace-wing fly made beneath an empty pupa of a lady-beetle on an avocado leaf.

Pseudococcus lounsburyi.—Mr. Ehrhorn exhibited this mealybug on bulbs of *Zepharanthus*, and reported it as occurring also on bulbs of *Crinum*, the spider lily, and other such plants. It was first recorded in Africa on *Agapanthus*.

Araucaria aphid.—Mr. Timberlake exhibited a mounted specimen of an aphid found abundant on tips of young shoots of *Araucaria* in Kapiolani Park, January 30th. It was apparently a species not previously observed here, as it is not in Fullaway's catalogue of the Aphididæ of Hawaii.

Delphacids from Kilauea.—Mr. Giffard reported having collected a considerable number of Delphacids at Kilauea, Hawaii, on trips made in October, 1915, and January, 1916. Enough material was obtained to add largely to our knowledge of this family as regards number of species, food-plants, seasonal occurrence, etc.

Mr. Bridwell made the following exhibits with remarks on the same:

Houseflies.—Several species of *Musca* reared from cow dung in Africa and Australia, some of which resemble the housefly and are distinguished from it with difficulty.

Dolichurus n. sp..—In a nest in a plant stem were found two roach nymphs, on one of which a larva was feeding. It ate both roaches and spun up in May. The adult emerged in September and proved to be this fossorial wasp of the family Ampulicidæ. It was taken near the Rhodes' monument in Cape Town.

Quartinia capensis.—This, and five new species of the same genus, which are the smallest known Vespoid wasps.

Neuroptera.—Specimens of the largest known antlion and the smallest known *Mantispa*, and other interesting Neuroptera.

Paropsis.—A number of species of this Chrysomelid genus, which has 200 to 300 species in Australia.

Lycus.—Several species of this genus of Lampyridæ from Nigeria.

Xylocopa.—Several interesting species of these carpenter bees from Africa.

Dryotribus mimeticus.—Professor Illingworth exhibited specimens of this weevil. He had collected three or four dozen under a log on the beach at Koko Head, August, 1915.

MARCH 2ND, 1916.

The one hundred twenty-sixth meeting was held in the usual place, President Illingworth in the chair. Other members present: Messrs. Bridwell, Ehrhorn, Giffard, Mant, Swezey and Timberlake.

Minutes of previous meeting read and approved.

Mr. P. H. Timberlake elected to active membership.

NOTES AND EXHIBITIONS.

Hemiteles variegatus.—Mr. Ehrhorn reported having reared this parasite from the *Chrysopa micropHYa* cocoon exhibited by him at the previous meeting.

Mr. Bridwell made the following exhibits with remarks thereon:

Allodape and *Exoneura.*—Specimens of these African and Australian bees and notes on their habits.

Australian Buprestids.—Specimens illustrating extremes in size. A species of *Stigmodera* was about two inches in length, while *Germaria casuarinae* was only about one-eighth of an inch.

Agriotypus sp.—A single specimen collected by Mr. F. Muir at Okitsu, Japan. It belongs to a family containing but one described species, *Agriotypus armatus* of Europe, which is parasitic on caddis-fly larvae.

A common cricket caught on the barbs of a grass head, *Cenchrus echinatus*, and still alive.

Odonaspis ruthae.—Mr. Ehrhorn called attention to Mr. Kotinsky's description of this scale insect in Proceedings of the Entomological Society of Washington, XVII, p. 101, figs. 1 & 2, 1915.

Pinaspis buxi.—Mr. Ehrhorn stated that this scale is one of those that has been known here as *Fiorina fiorinae* until a recent determination by Mr. Sasseer.

Curculionids.—Mr. Swezey exhibited the following species of weevils collected by Mr. Giffard on Oahu:

Deinocossonus nesiotes var. *oahuensis*.

Pentarthrum obscurum.

Orothreptes callithrix.

Calandra remota.—Originally collected in banana stems, but recently a specimen was taken in beating "ieie" vines.

No one has collected specimens of these species in recent years except Mr. Giffard.

Mr. Giffard mentioned the use of acetic ether in keeping freshly caught insects relaxed for a long time till convenient to mount them. A general discussion of this and other methods of handling specimens followed.

Notes on Two Species of Hawaiian Diptera.

BY J. F. ILLINGWORTH.

The student of diptera has a rich field in Hawaii. Many of the native species are apparently new; and the literature of the Islands, often, hardly mentions some introduced fly which is very abundant. The latter is the case with the two species recorded in this paper.

Brachydeutera argentata Walk.

Hab. Southern United States as far as Kansas; Cuba, Brazil, Bolivia, and Paraguay.

Hawaiian records. First specimen obtained by Dr. Perkins at Olaa, Hawaii, July, 1895. Dr. Howard, Oct. 1900, records three specimens from Hawaii, and a single specimen was taken in the Iao Valley, Maui, Sept. 1901.

Of the specimens in collections, the Hawaiian Sugar Planters' Association has two specimens taken on Molokai, 1907, and four at Waikiki, 1906 and 1907. The College of Hawaii collection has one specimen, 1911, and five specimens, 1914.

The indication would be that these flies are rare, but I found them exceedingly abundant, after the recent heavy rains, both at the College of Hawaii and along the Palolo stream. Those at the College were found under the insectary, in the water basins, which had not been cleaned out for some time. The water was brown in color, and had considerable leaf-trash in the bottom.

These flies, as is characteristic of the family, have a waterproof coat and run about freely upon the surface.

Habits of larvae: The larvae are able to remain submerged for indefinite periods, while feeding, but as soon as they finish they rise and apply their caudal spiracles to the surface of the water, where they hang motionless. The food is apparently the same as that eaten by mosquito larvae. They were observed eating the remains of a sowbug which was decaying

in the bottom, and they could constantly be seen browsing upon the microscopic algae that covered the sides of the jar and the submerged leaves. They fed peaceably, side by side, with the mosquitoes, which swarmed in the same water.

Pupae: The outer coat of the full-grown larva hardens into the puparium, with slight change in form, except that a pair of prominent horns terminate the cephalic portion. At this stage they become very buoyant and float in masses or lodge at the edges of the vessel.

Professor J. M. Aldrich gives an interesting account* of the use of the puparia of closely related flies for food by the Indians of the Western United States.

Fannia (Homalomyia) pusio (Wiedemann).†

Hab. South America, ranging north through West Indies into Southern United States.

Hawaiian records. The collection of the Hawaiian Sugar Planters' Association has seven specimens taken in Honolulu from 1904 to 1907, also two specimens from Hawaii, 1905. There are no specimens in the College of Hawaii collected previous to 1914.

Food habits of larvae: The specimens in the collections of Honolulu show that they have been reared from meat, papaia stem, and dead Japanese beetles by Mr. Terry; and from soured bread, dead cockroaches and chicken manure by the writer. The latter substance was swarming with them.

Eggs: The eggs are white, beautifully sculptured, and have a median ridge above and a pair of lateral wings which extend the entire length. They are laid in great numbers upon the surface of the food supply.

Larvae: The larvae, when freed from the substance in which they are feeding, are beautiful objects. They are brown in color and bear two prominent rows of fringed appendages, which extend along the sides and around the caudal border. A

* Journ. N. Y. Ent. Soc. XX, 90-92.

† The species has been determined by Frederick Knab, of the U. S. National Museum, who states that it was described from South America, and is evidently widely distributed.

pair of slender appendages, also, project from the cephalic border.

Pupa: To pupate the mature larvae crawl out of the food substance, seeking a dry place to hibernate. They do not pass through any material change in form, but simply dry, contracting somewhat. The period of development resembles very closely that of the ordinary housefly.

The adult flies are very commonly taken about the flowers of the algaroba.

APRIL 6TH, 1916.

The one hundred twenty-seventh meeting of the Society was held in the usual place, President Illingworth in the chair. Other members present: Messrs. Bridwell, Bryan, Ehrhorn, Giffard, Kuhns, Muir, Pemberton, Swezey, and Timberlake.

Minutes of previous meeting read and approved.

NOTES AND EXHIBITIONS.

Diptera determinations.—Mr. Swezey exhibited specimens of six species of flies which had recently been determined for him by Mr. F. Knab at the U. S. National Museum, from specimens sent to him.

Sciapus pachygyna Macq.—A Dolichopodid that is common in the cane fields on Hawaii. Originally described from Australia.

Ophyra nigra Wied.—A very common black Anthomyid. Described from China and widely distributed in the Orient.

Scholastes bimaculatus Hendel.—The coconut fly (*Paragorgopsis*?) mentioned in Proc. Haw. Ent. Soc. III, p. 70, 1915. Now and then a specimen is taken on windows in Honolulu. Described from Fiji.

Lynchia maura Bigot.—The pigeon fly, which is now very abundant on pigeons in Honolulu. For notes on its occurrence here see Proc. Haw. Ent. Soc., II, p. 188, 1912, and II, p. 206, 1913. Common in the Mediterranean region; also widely distributed through the warmer parts of America.

Chrysomyia dux Esch.

Lucilia sericata Meig.—The two latter are green bottle flies and were determined by Dr. C. H. T. Townsend.

Hippoboscid.—Professor Bryan mentioned having taken a large species from a man-o'-war bird at Moku Manu or Bird Island, off windward Oahu.

Dictyophorodelphax mirabilis.—Mr. Timberlake mentioned having collected a single adult of this remarkable Delphacid, from *Pittosporum*, on the ridge leading up from Alewa Heights to Lanihuli. Mr. Bridwell also secured a specimen from the same tree. This is the first record of the collecting of this insect anywhere except at the original locality on the Kaumuohona ridge near the base of Mt. Konahuanui.

A New Anthribid.—Mr. Timberlake exhibited a small Anthribid with long antennae, of which he had collected several specimens recently in Honolulu. A species not as yet determined or recorded, though Dr. Perkins has stated in the Introduction to *The Fauna Hawaiiensis* that one or two recently introduced species have been observed in Honolulu. In this connection, Mr. Ehrhorn discussed the collecting of rare insects in large numbers, at times, or special occasions, and related how Mr. Fuchs of California was accustomed to return to localities where he had on former occasions taken rare or interesting insects. Other members related incidents of unexpectedly taking a large number of specimens of some hitherto rare species.

Trypoxylon bicolor.—Mr. Bridwell reported having bred this wasp from cells found in rotten wood of *Pisonia*, on Tantalus.

Heteropoda regia.—Mr. Pemberton reported having observed a female spider of this species make her egg-sac, which she carried with her until the eggs hatched. It was 35 days, and she would not eat anything in all this time. When the 530 young spiders hatched, no cannibalism was observed among them. On the day that she dropped the empty egg-sac, the female broke her long fast by eating a cockroach.

Telespiza ultima.—Professor Bryan said that he had for a time entertained suspicions of there being a new bird on Nihoa, a small island about 200 miles beyond Kauai, and was much

elated when Captain Brown of the U. S. revenue cutter "Thetis" brought him five specimens which he had secured on his last trip to the island. It is related to the Laysan Island canary, and Professor Bryan has described it as *Telepiza ultima*.

Clerada Apicicornis Sucking Blood. (Hemip.).

BY J. F. ILLINGWORTH.

This predaceous bug is commonly found about buildings; and there has been some question as to its feeding habits. Kirkaldy suspected that it fed on *Lepisma* and small Blattids, and Dr. Perkins saw a specimen feeding on a dead roach.

These insects, in all stages, are often very common in the piles of dry wood in the shops of the College. I have never found them numerous in the house, but from time to time we find individuals. Upon two occasions we have taken them in the beds; and, just recently, I caught an adult, full of blood, upon one of the sleeping children. The place bitten was red and resembled a flea-bite.

Habitat: The Fauna Hawaiiensis gives the distribution of this species: Réunion, Celebes, Bengal, Cuba, St. Thomas, Venezuela, etc.; also, a note that it was taken by beating dead branches of a species of palm in mountain forests, on Oahu.

Webbing Clothes Moth Predaceous.

BY J. F. ILLINGWORTH.

Recently the brushes at the College of Hawaii were found to be badly eaten by the webbing clothes moth (*Tineola biselliella* Hummel). The brushes had been purchased a year previously in the East.

The naked, full-grown larvae were collected and placed in a test-tube, with bits of tissue paper, so that they might pupate. Several cocoons with almost-mature pupae were put in with them. Having no other food, the larvae dug into these cocoons, during the night, and ate the living pupae, before they spun-up themselves.

MAY 4TH, 1916.

The one hundred twenty-eighth meeting of the Society was held in the usual place, President Illingworth in the chair. Other members present: Messrs. Bridwell, Ehrhorn, Kuhns, Mant, Swezey, and Timberlake.

Minutes of previous meeting read and approved.

ENTOMOLOGICAL PROGRAM.

Eupelmus sp.—Mr. Bridwell exhibited a very large species similar to a species bred by Mr. Swezey previously from *Aristotelia* sp. in galls on stem of *Gouldia*.

Aegosoma reflexum.—A specimen exhibited by Mr. Bridwell, which he had bred from a large pupa found in dead ohia wood on the main ridge back of Palolo Valley. This large Prionid has seldom been taken on Oahu, it being more common on Hawaii.

Nesocrabro stygius.—A nest of this wasp was found by Mr. Bridwell in fallen wood on the ground. It was provisioned with *Discritomyia* flies. Dr. Perkins has given the habit of this wasp as nesting in the ground.

Nesomimesa antennata.—Mr. Bridwell recorded the finding of this wasp nesting in cavities in the dead stem of *Erigeron*. Previously recorded by Dr. Perkins as nesting in the ground.

Psammochares luctuosus.—A cocoon of this Pompilid was found by Mr. Bridwell in rotten wood at about 1,500 feet elevation in the mountains. It has been known as usually nesting in the ground. The opinion was expressed that perhaps unusually wet conditions of the ground had caused the unusual nesting of these wasps.

Heteramphus swezeyi.—A freshly formed adult of this weevil was exhibited by Mr. Bridwell. It had emerged from a pupa found in the mine formed by its larva in the frond of *Elaphoglossum* on Waialae-Nui ridge, April 30, 1916.

Omiodes blackburni.—Professor Illingworth reported finding large numbers of the palm leaf-roller killed by wilt disease.

Pteromalus puparum.—Mr. Ehrhorn inquired whether anyone had taken this insect. None had. Attempts at its introduction here had been made by both him and Mr. Koebele.

Attagenus plebius.—Professor Illingworth reported this Dermestid abundant in clothing in trunks. He is working on its life history.

Smilax insects.—In dead stems of *Smilax* on Waialae-Nui ridge, April 30, Mr. Swezey found the following insects, which were exhibited:

Semnoprepia sp.—Larvae and empty pupae.

Oodemus sp.—Adult, larvae and pupae.

Anobiid.—Two adults, one freshly emerged.

Dromaeolus sp.—Larva.

Scleroderma sp.—Two females, one larva.

Eupelmus sp.—One larva feeding on *Oodemus* larva, one pupa from which an adult emerged May 11.

Notes on a Peregrine Bethylid.

BY J. C. BRIDWELL.

Additional species of immigrant Bethylidae are constantly appearing in the Hawaiian Islands. The present paper describes and gives a summary of our knowledge of the distribution of a recently discovered species of *Epyris*, the first authentic species of the genus taken here. Ashmead (Fauna Hawaiiensis I, p. 286, 1901) described an *Epyris hawaiiensis*, but in revising the genera of the family the Abbé Kieffer has referred the species to his newly established genus *Holepyris* (Ann. Soc. Scient. de Bruxelles 29:111, 1905).

The first adult of this new species was taken by Mr. Swezey on a sugar cane leaf in the Experiment Station grounds of the H. S. P. A. in Honolulu on October 27, 1915, and another on the window of his laboratory there on Nov. 12,

as reported in the present volume of these proceedings, pp. 222 and 223. Subsequently on Feb. 6, 1916, he took it upon the elevated coral reef east of Diamond Head. Early in April the writer found it abundant among the flowers and on the foliage of *klu* (*Acacia farnesiana*) and algeroba (*Prosopis juliflora*) along the road on the ocean side of Diamond Head. Mr. Swezey took it near Pearl City on Sept. 11; the writer found it among the grass on the Ewa coral plain below Sisal on Nov. 28; and Mr. Swezey on Jan. 17, 1917, in the cane-fields above Waipio. I found it in November, 1916, at the base of Koko Head crater under stones with Tenebrionid beetles. Mr. Fullaway informs me that Mr. Giffard and he have taken it in 1917 at the Nuuanu Pali.

In its behavior it is much like the smaller species of *Tiphia**. I have frequently seen it running about on the ground and in one case it entered the ground in an exploratory way thru a crevice. I believe it to be parasitic upon the larvae of some or all of our species of Tenebrionid beetles (*Alphitobius*, *Gonocephalum*, and *Blapstinus*) which are abundant in the areas where the wasp has been taken. So far as I can learn none of the species of *Epyris* have been bred but I have taken a smaller *Epyris* at Capetown carrying in its jaws a Tenebrionid larva larger than itself, and Mr. H. T. Osborn observed near Pearl City on Sept. 4, 1915, while searching for traces of *Tiphia* larvae on *Anomala* grubs, a Tenebrionid larva parasitized by an external Hymenopterous larva resembling that of *Tiphia*. This perished without transforming, but as we know no other wasp here to which the larva could well be assigned, I am convinced that he had the larva of our *Epyris* before its adult had been discovered.

The species corresponds to none of the North American species of *Epyris* described by Ashmead under *Mesitius* nor with the European forms so admirably described by the Abbé Kieffer. It is here described as new:

*I am convinced that the association of this family with the Scolioid wasps and the Chrysididae is eminently natural and that any resemblance with the Serphoid (Proctotrypoid) forms is purely superficial.

Epyris extraneus sp. nov.

♀ Lenth, about 6mm. Black; mandibles yellowish; antennae largely, tegulae, femora more or less, tibiae and tarsi largely piceus.

Head square, sparsely punctate, shining; mandibles half the length of the head, swollen toward the apex, hirsute outwardly, a broad longitudinal margined groove beneath; emarginate within toward the middle, beyond this with one large denticle and three smaller ones, apex acute and bent down and inward, beneath and within the apex another denticle and a series of flat spinules; malar space almost absent; eyes glabrous, a third longer than their distance from the occipital margin of the head; hind ocelli a little less distant from the hind margin of the head than from each other or the anterior ocellus and about four or five times farther from the eye than from each other. Antennae tapering towards the apex and very finely pubescent, scape large, curved, hirsute, not quite as long as the four succeeding joints; joints two and three narrower and somewhat shorter than those succeeding which are sub-equal and a little longer than broad.

Pronotum a little longer than wide, broadening posteriorly where it attains the width of the head, with coarse sparse punctures. Mesonotum not half the length of the pronotum, impunctate except for a few small punctures on either side of the expanded portion of the parapsidal furrows, these expanded and slightly converging posteriorly, exterior furrows not percurrent, the three lobes subequal. Scutellum about as long as the mesonotum, subtriangular, impunctate, the basal pits broadly elliptical, arranged obliquely a little outside the ends of the parapsidal furrows, distant from each other about four times their length. Propodeum as long as the mesonotum and scutellum together, square, margined, with five longitudinal carinae, the outer carinae slightly converging behind, distant from the lateral margins, area outside the carinae finely transversely striate; declivous portion slightly concave, margined, finely transversely striate and divided by a shallow longitudinal furrow; sides of propodeum finely longitudinally striate.

Wings yellowish with the venation and stigma yellow; stigma oval; median cell broader than the submedian; the basal vein oblique, inserted at the base of the stigma; submedian cell longer than the median; transverse vein as long as the basal, arched, with a very slight trace of a vein arising from before its middle; radius twice as long as the basal, not attaining the apex of the wing by more than its own length.

Anterior femora greatly expanded and thickened, broader and longer than the other femora; anterior tibiae not particularly larger than the middle ones; middle tibiae spinose; anterior tarsi longer than their tibiae, the first four segments bearing long stout flattened obtuse spines on the outer margin and similar shorter spines beneath, the metatarsus as long as the next three joints together, these as broad as long.

♂ 4 to 5 mm. long. Slenderer than the female. Antennae black, longer than the head and thorax together; scape not longer nor much

thicker than the third segment, which is about two and one-half times as long as wide; second antennal segment about one-half as long as wide, and narrower than the third; third and succeeding joints subequal, gradually tapering to the apex. Sculpture of head and thorax somewhat coarser and less sparse than in the female. Mouth parts and tarsi more yellowish than in the female. Mandibles obliquely truncate at the apex, with a strong and acute apical tooth, the truncation quadridenticulate, with the inner denticle somewhat produced. Anterior tarsi not appendiculate; middle tibiae not spinose.

Described from eleven females and eight males taken on Oahu at Diamond Head April, 1916, and four females from Koko Head November, 1916, (J. C. Bridwell).

Type, female and male, and paratypes in the entomological collection of the B. P. Bishop Museum of Polynesian Ethnology and Natural History, and paratypes in the author's collection.

Closely related to *Epyris armatitarsis* Kieffer from Tunis, the excellent description of which (Ann. Mus. Civ. Storia Nat. Genova (3) 1:399, 1904) has been followed in detail here. The principal difference appears to lie in the structure of the mandibles. It is probable, however, that there is less difference than appears in the descriptions on account of the difficulty in making out the peculiar structure of these distorted organs.

Notes on *Dictyophorodelphax mirabilis*.

BY J. C. BRIDWELL.

Among the Hawaiian insects *Dictyophorodelphax mirabilis* Swezey has been of particular interest on account of its peculiar form and limited distribution. Its enormously prolonged head is a peculiar development very rare among the Delphacids, and the genus appears to be an endemic development from the ordinary types of Delphacidae in the Islands.

Mr. Swezey has already described the nymphal forms as well as the adults. Until recently it had appeared to be confined to a single ridge of the Koolau mountains, but Mr. Timberlake has extended its known range to the ridge opposite its

first discovered habitat, across the broad Nuuanu Valley, the most important dividing valley of the range.

Hitherto its food-plant has remained undetermined. It had been originally taken only in small numbers sweeping over the staghorn fern (*Gleichenia*) and other vegetation along the old native trail on the crest of Kaumuohona ridge. Mr. Timberlake and I had each taken a single male on *Pittosporum* on the Lanihuli ridge at about the same elevation as its original habitat.

On April 23, while collecting with Mr. Timberlake along the Castle trail, in returning we separated and I proceeded along the old ridge trail back to the Cooke trail descending into Nuuanu Valley, hoping to secure further material of this species of which even as yet only a few specimens had been taken, and perhaps to solve the problem of its food-plant. After a few strokes of the sweep-net over ferns and other low vegetation, four adults were seen in the net. For some time this process was continued, keeping in mind the plants swept over, and it soon became evident that aside from the common ferns and *Metrosideros*, the only possible food-plant among those swept would be *Euphorbia clusiaefolia*. The first plant examined disclosed one adult, and repeated examinations others both adults and nymphs. In one case a single leaf bore on its under side about a dozen individuals, including two or three nymphs. This leaf was placed in a glass tube and carried home. During the succeeding week one of the nymphs completed its transformations and the greater part of the individuals remained in a living condition until the leaf withered. In all about 50 individuals of the species were taken, being all found in the region where the host-plant was present.

Euphorbia clusiaefolia thus appears to be the proper host-plant for the species. This plant appears to be generally distributed along the lateral ridges back of Honolulu, though in no other place have I happened to find it so abundant as on this particular ridge. We may perhaps hope to extend our knowledge of the distribution of the species by a careful examination of the plant in other parts of its range.

JUNE 1st, 1916.

The one hundred twenty-ninth meeting was held in the usual place, President Illingworth in the chair. Other members present: Messrs. Bridwell, Ehrhorn, Fullaway, Kuhns, Mant, Pemberton, Swezey, and Timberlake.

Minutes of previous meeting read and approved.

NOTES AND EXHIBITIONS.

Psyllid parasite.—Mr. Timberlake exhibited specimens of a parasite bred from galls of a Psyllid (*Trioza iolani*) on ohia leaves brought in by Mr. Swezey, from a ridge back of Hauula; also from Waialae-Nui. The galls were numerous on the few leaves brought in, and about 50 of the parasites had bred out. It is a Eulophine thought to be near the genus *Sympiesis*.

Adelencyrtus kaalae Ashm.—Mr. Timberlake exhibited specimens collected in various places in the Islands, hosts unknown, and expressed the opinion that the species should be placed in some other genus.

Beetles in alfalfa meal.—Prof. Illingworth reported finding Clerid beetles breeding very abundantly in alfalfa meal. The larva were reddish.

Catorama mexicana.—Prof. Illingworth reported this beetle feeding in slippers.

Cerapachys silvestrii Wh.—Mr. Swezey exhibited specimens of this ant which he had found nesting in a compost heap at the Experiment Station grounds. This is the first time that it has been collected since its discovery at Hilo by Dr. Silvestri in 1908.

Aegosoma reflexum.—Mr. Bridwell reported that the beetle from his previously exhibited pupa finally became fully matured and hardened up.

Pseudococcus nipae.—Mr. Ehrhorn remarked on the usual scarcity of this mealybug, in several instances that had come under his observation it had entirely disappeared. Others mentioned similar observations.

Aramigus fulleri.—Mr. Kuhns reported that George Lucas had told him that this beetle was injuring the ferns in his fern-house.

Antonina indica.—Mr. Ehrhorn reported that Mr. Green in a recent letter had informed him that what has been known here as *Antonina boutelouae* is *A. indica*. This is the species on Bermuda grass.

JULY 6TH, 1916.

The one hundred thirtieth meeting was held in the usual place. In the absence of the President and Vice-President, the Secretary called the meeting to order and Mr. Fullaway was elected chairman for the meeting. Members present: Messrs. Bridwell, Ehrhorn, Fullaway, Kuhns, Pemberton, Swezey, and Timberlake.

Minutes of previous meeting read and approved.

NOTES AND EXHIBITIONS.

Dictyophorodelphax mirabilis.—Mr. Timberlake exhibited a female of this Delphacid captured on *Euphorbia hillebrandi*, on Mt. Kaala, July 4th. Messrs. Swezey and Bridwell secured nymphs also from the same place. The range of this remarkable insect is thus widely extended, it having been collected previously only on ridges each side of Nuuanu Valley.

Callithmysus cristatus.—Mr. Timberlake exhibited three specimens of this Cerambycid taken at various places on Oahu. He also exhibited two other species, one of which was from Kaala and seemed to be different from any described species. Mr. Swezey exhibited a very large specimen of another *Callithmysus* or *Plagithmysus* taken also on Kaala and apparently being another new species.

Pachycrepoides dubius.—Mr. Fullaway exhibited this Philippine Pteromalid which was introduced about two years ago and is now found to be established. Mr. Pemberton reported having bred it from *Ceratitis capitata* on seven occasions, and from at least three different localities.

Platymischoides sp.—Mr. Bridwell exhibited two species of wingless Diapriids of this genus, one collected on Mt. Olym-

pus and the other on Mt. Kaala. He also exhibited two Dryinids collected in the mountains.

Proterhinus maurus.—Mr. Bridwell exhibited specimens of this very large *Proterhinus*, collected on *Suttonia lessertiana* on the main ridge at the head of Palolo valley on June 18 and July 2.

Rhyncogonus koebeleii.—Mr. Bridwell exhibited three specimens of this weevil, collected by him on the tips of the branches of *Broussaisia*, on the Olympus trail, Palolo, June 18th. Mr. Kuhns remarked that he had always found this species on *Scaevola*.

Wingless Hemerobiid.—Mr. Bridwell reported having collected a few specimens on Mt. Kaala, July 4th.

Delphacids from Kaala.—Mr. Swezey reported having collected quite a number of species of these leafhoppers on Mt. Kaala, July 4th, two of which may be new species, being collected respectively on *Astelia* and *Gunnera*.

AUGUST 3RD, 1916.

The one hundred thirty-first meeting of the Society was held in the usual place. The President and Vice-President being absent, the Secretary called the meeting to order, after which Professor Bryan was elected chairman for the meeting. Members present: Messrs. Bridwell, Bryan, Fullaway, Ehrenhorn, Mant, Osborn, Pemberton, Swezey, and Timberlake.

Minutes of previous meeting read and approved.

NOTES AND EXHIBITIONS.

Nesosydne leahi.—Mr. Timberlake exhibited specimens of this Delphacid collected on *Lipochaeta* at Kuliouou, June 25th. A branch of the plant was brought in and several egg-parasites emerged from the leafhopper eggs therein—*Anagrus frequens* and *Polynema* (probably a new species). Very few leafhoppers hatched out. This leafhopper had not been collected on Oahu since the time that Kirkaldy collected it in Diamond Head crater at the time it was described. Mr. Swezey col-

lected it at Waimea, Kauai, in February, 1915, where it was also found on *Lipochaeta*.

Oxaxis collaris.—Mr. Bridwell called attention to the abundance of this Oedemerid beetle lately. He had collected them by the dozen at the lights at the Pawaa Junction waiting station. He said that Mr. Timberlake had also mentioned noticing them at lights at the Hotel Macdonald.

Distribution of insects per elevation.—Professor Bryan asked how the different members had found the distribution of insects to be influenced by the elevation. Mr. Swezey discussed this with regard to the Lepidoptera, showing that their distribution is chiefly influenced by the food-plant, whose distribution is in turn influenced by elevation, and depending on climatic conditions. Mr. Bridwell discussed the question as to Hymenoptera, especially wasps. The latter being limited by their habits of nesting, whether in the ground, in holes in rocks, in hollow stems or excavations in rotten wood. The selection of caterpillars by the species of *Odynerus* was discussed at some length. In the main they took whatever was available, although some species had favorites. Mr. Bridwell mentioned having observed a *Crabro* in California which had supplied its nest with Chalcids instead of flies as the species of that genus usually do. The nests were in galls on willow.

Chrysidid.—Mr. Ehrhorn reported this insect now quite abundant in Manoa Valley. He had observed one enter the open cell of a *Sceliphron* nest. Others reported having captured it lately. Mr. Swezey reported seeing one at Waipio the previous day. This is the farthest from Honolulu that it has been observed.

Cerapachys silvestrii.—Mr. Ehrhorn, experimenting on this ant, found that they clustered among aphids on *Purslane* in his breeding jar. They have a peculiar habit of carrying their larvae longitudinally underneath, between the legs.

Solenopsis geminata.—Mr. Fullaway reported finding the fire ant eating out the eggs of the melon fly in Manila. Mr. Osborn reported this ant as also eating out the eggs of the corn leafhopper in Manila.

SEPTEMBER 7TH, 1916.

The one hundred thirty-second meeting of the Society was held in the usual place, President Illingworth in the chair. Other members present: Messrs. Bridwell, Ehrhorn, Fullaway, Kuhns, Pemberton, Swezey, Timberlake, and W. H. Meinecke, visitor.

Minutes of previous meeting read and approved.

NOTES AND EXHIBITIONS.

Neoexaireta spiniger.—Mr. Pemberton exhibited a specimen of this fly captured in Kona, Hawaii, where they were hovering about heaps of coffee pomace in which it was thought that the larvae were feeding. Other members mentioned rotten sugar cane, banana stems and other rotting vegetation as breeding-places of this fly.

Insects from the crater of Mauna Loa.—Mr. Meinecke exhibited insects collected by him, August 1st, in Mokuaweoweo, the crater of Mauna Loa, Hawaii. Some of them were on the rocks and some on snow. This was at an elevation of about 14,000 feet. They must have been carried to the place by air currents, it being a long distance and much higher than any possible breeding-places for any of them. Following is a list as determined by Mr. Swezey:

Hymenoptera

- 1 *Psammochares luctuosus* (Cr.)
- 6 *Bassus lactatorius* (Fab.)
- 3 *Limnerium blackburni* Cam.

Diptera

- 4 *Xanthogramma grandicorne* Macq.
- 1 *Sarcophaga pallinervis* Thoms.
- 2 *Frontina archippivora* Will.
- 4 of an undetermined species.

Lepidoptera

- 1 *Pontia rapae* (Linn.)
- 1 *Scotorythra rara* Butl.
- 2 *Eccoctocera foeterivorans* (Butl.)

Hemiptera

7 *Nysius delectus* White.

5 *Nysius coenosulus* White.

Myrmeleo wilsoni McL.—Mr. Meinecke exhibited several specimens of this ant-lion captured by him at a sandy place on the road at Pohakuloa, Hawaii, which was about five miles from the Humuula sheep station towards Waimea. He reported seeing them also on the road towards Waikē. Mr. Ehrhorn mentioned having seen them at Puuwaawaa, Hawaii, several years ago. Mr. Bridwell reported having seen in West Africa a swarm of ant-lions moving along. He also reported having found in Africa a Leptid fly of the genus *Vermileo* making pits similar to those of ant-lions.

Hawaiian Ophionidae.—Mr. Fullaway exhibited specimens of Mr. Giffard's collection of Ophionidae, illustrating the different genera: *Enicospilus*, *Pleuroneurophion*, *Athyreodon*, *Eremotyloides*, *Banchogastra*, and *Pycnophion*.

Enicospilus dispilus.—Mr. Bridwell mentioned having secured 17 specimens of this species on Lanihuli, Sept. 3rd. They were swarming together.

Egg-parasites of the corn leafhopper.—Mr. Fullaway reported having bred from corn leafhopper eggs, the parasites of the sugar cane leafhopper, *Paranagrus optabilis*, *Ootetrastichus beatus*, and a dark *Anagrus* besides. From cages of corn leafhopper parasite material brought by Mr. Osborn from the Philippines, he had bred a species of *Paranagrus*, a dark Mymarid and a dark species of *Ootetrastichus*.

Chrysidid.—Mr. Bridwell stated that he had found a cocoon of this insect in a *Sceliphron* nest under circumstances that demonstrated it to be a parasite of that wasp.

Notes on Life History of *Attagenus Plebius* Sharp.

BY J. F. ILLINGWORTH.

The very destructive habits of this Hawaiian household beetle first came to my attention several months ago, when I opened up two trunks, which had been stored for some time. Everything of animal origin was riddled. Since I am unable to find any notes on the habits or life history of this species, I have made a rather careful study of them.

DISTRIBUTION.

So far as I can learn, these beetles have not been found outside of the Hawaiian Islands. Sharp* named the species from specimens secured here, and remarks that they are found in houses in Honolulu. They are probably found on all of our islands, for we have specimens from Maui, and Mr. D. B. Kuhns tells me that they are a pest on the Island of Hawaii.

LIFE HISTORY.

After securing newly emerged beetles they were confined in a covered glass dish for thirty-six days before the first eggs and newly-hatched larvae were discovered upon the woolen cloth which had been supplied them together with dried insects for food. It was found that the larval period consists of seven instars, and varies slightly, probably due to the kind of food, etc. The pupal stage lasts from twelve to fourteen days. The periods of two of the individuals are given as typical of those under observation:

Larva Hatched	2nd Instar	3rd Instar	4th Instar	5th Instar	6th Instar	7th Instar	Pupal Instar	Adult Emerged	Total
Feb. 15, 1916	Feb. 26	Mar. 16	Mar. 30	May 4	May 19	June 5	July 8	July 20	156 Dys.
April 14, 1916	Apr. 24	May 12	May 24	June 8	June 20	July 15	Aug. 30	Sept. 11	150 Dys.

It is interesting to note the rapidity with which these insects develop under our tropical climate. Chittenden found that two years were required for the development of the closely-

* Trans. Royal Dublin Soc. Vol. III. Ser. II. 1885, p. 147.

Proc. Haw. Ent. Soc. III, No. 4, May, 1917.

related, black, carpet beetle (*Attagmus piceus*), in the United States.

CONTROL MEASURES.

Carbon bisulphide was used successfully in destroying the insects in the trunks, but the treatment had to be repeated after about two weeks, when some young larvae were again discovered. Possibly the eggs are not destroyed by the treatment, and this may account for the second appearance of the pest, unless the young larvae crawled in from the outside.

OCTOBER 5TH, 1916.

The one hundred thirty-third meeting of the Society was held in the usual place, President Illingworth in the chair. Other members present: Messrs. Bridwell, Ehrhorn, Fullaway, Giffard, Kuhns, Pemberton, Swezey and Timberlake.

Minutes of previous meeting read and approved.

NOTES AND EXHIBITIONS.

Diachus auratus.—Mr. Fullaway exhibited a specimen of this American Chrysomelid beetle from the Board of Agriculture collection, collected by Mr. J. Kotinsky, at Waianae in 1909. The earliest previous record of its occurrence was 1913,* collected by Mr. Swezey in Honolulu and also in Honolulu Plantation above Pearl City, at which time specimens were sent to Dr. Van Dyke for determination.

Lithurgus albofimbriatus.—Mr. Bridwell reported his first capture of this bee in September on morning glory blossoms at Black Point, east of Diamond Head.

Mezium sp.—Mr. Bridwell reported finding this peculiar Ptinid beetle numerous in sparrow nests in a cave-like excavation at the side of the Diamond Head road. There were also some of them in crevices of the rocks. Hen fleas were also found in the sparrow nests.

Chrysidid.—Mr. Bridwell reported finding cocoons and adults of this insect in *Sceliphron* nests in a road culvert at Diamond Head.

* Proc. Haw. Ent. Soc., III, p. 11, 1914, and III, p. 62, 1915.

Epyris sp.—Reported by Mr. Bridwell as being very abundant in the locality where previously observed in waste land at the east of Diamond Head. One was observed to sweep down to the ground and burrow in.

Crabro distinctus.—Mr. Bridwell reported the present absence of this wasp where he had found it abundant in April on Crotons near Diamond Head.

Throscus sp.—Mr. Bridwell exhibited a specimen of this small beetle of the family Throscidae, near to the Elateridae, recently caught by him at light. No representative of this family had yet been recorded here.

Argentine ant.—Mr. Ehrhorn reported that in his inspection work recently he had found a colony of this ant in a case of plants from Alameda County, California. It was the first finding of this pest, and they were of course promptly destroyed. Mr. Giffard stated that he noticed the houses overrun with this pest at Birmingham this summer.

Methoca sp.—Mr. Swezey exhibited a specimen of the family Thynnidae which Mr. Bridwell had recognized as a *Methoca*. It had recently issued from a cocoon amongst others found in the ground by Mr. Osborn at Los Banos, P. I. Mr. Bridwell gave a resume of the known habits of this genus of Thynnidae. They are most abundant in South Africa. None have previously been reported in the Philippines.

Mutillid.—Mr. Swezey exhibited a female Mutillid that was found in a cage in which adult *Scolia* were sent from the Philippines. No doubt it had issued from a cocoon accidentally occurring in the soil of the cage.

Rhipiphorid beetle.—A specimen of a species of Rhipiphoridae was exhibited by Mr. Swezey. In examining some apparently dead *Scolia* cocoons from the Philippines, Mr. Timberlake had found this beetle alive in one of them. The *Scolia* cocoon was of a batch that had been reared in the insectary at Los Banos, and it is somewhat of a mystery how the *Scolia* became parasitized by this insect. Possibly it was by a triungulin larva being present in the soil used in the breeding cage. Mr. Timberlake suggested that the triungulin might have been

present on the adult *Scolia* used in the cage, she having been caught in the field.

Scolia and Tiphia eggs.—Mr. Swezey exhibited photographs recently made by Mr. Potter, showing the eggs of *Scolia manilae* and two species of Philippine *Tiphia* on their respective host grubs. The egg of *Scolia manilae* stands up vertically on the ventral surface behind the legs on *Anomala* grub; that of *Tiphia compressa* lies on the side behind the hind leg on *Adoretus* grub; that of the other *Tiphia* lies on the side of next to the last segment of the abdomen just below the lateral fold on *Anomala* grub.

Pineapple weevil.*—Mr. Swezey exhibited photos of the work of a large weevil in pineapples, that he had recently received from Mr. A. R. Ritchie, the government entomologist in Jamaica, where in the infested district 75% of the pineapples were said to be injured by it.

NOVEMBER 2ND, 1916.

The one hundred thirty-fourth meeting of the Society was held in the usual place, President Illingworth in the chair. Other members present: Messrs. Bridwell, Ehrhorn, Fullaway, Giffard, Kuhns, Osborn, Pemberton, Potter, Swezey, and Timberlake.

Minutes of previous meeting read and approved.

Mr. Swezey was appointed a committee to interview the Director of the Bishop Museum regarding co-operation in the printing of The Proceedings.

Mr. Giffard was appointed a committee to confer with the trustees of the Hawaiian Sugar Planters' Association relative to financial assistance, the publication of the last number of The Proceedings having left the Treasury with a large deficit.

Messrs. Bridwell and Swezey were appointed a committee to draft resolutions embodying the sense of the Society regarding the disposal of "types" of Hawaiian insects.

* *Metamasius ritchiei* Marshall. Bulletin of Entomological Research, VII, p. 197, 1916. Ritchie, Journal of the Jamaica Agricultural Society, XX, pp. 316-318, 1916.

ENTOMOLOGICAL PROGRAM.

Mr. Bridwell exhibited a dividing instrument and a small metal scale which he had found very useful in making measurements of insects.

Iolania perkinsi.—Mr. Giffard exhibited a collection of 35 specimens of this Cixiid taken at light at his place at 4,000 feet elevation, Kilauea, Hawaii, during two weeks. Other insects were also taken. Psocids were abundant on one night.

Throscus sp.—Messrs. Giffard and Timberlake reported taking this beetle at the Pali. Mr. Swezey reported having taken it at light.

Description of a New Species of *Spalangia*.

BY D. T. FULLAWAY.

In connection with the work on the control of the horn fly (*Lyperosia irritans*), the writer introduced from the Philippines in 1914 a *Spalangia* bred from house fly and other muscid puparia. This species, which was multiplied and distributed throughout the islands, proves to be new to science, and is described herewith.

Spalangia philippinensis n. sp.

♀ Length 3mm. Black, the polished surfaces brilliant, tarsi brown with black tips.

Head vertical, fairly long and thin, about twice as long as the eyes, which are oval, flatly convex and hairy; surface smooth and shining but marked with broad shallow punctures and almost as hairy as the eyes. Face between the eyes broad, narrowing but little toward the mouth; clypeal margin truncate; cheeks flat and as long as the eyes; ocelli fairly large and arranged in an obtuse triangle, the lateral members a little further apart than from the eye margin, to anterior member about the same as to eye; a broad deep triangular groove on the lower part of the face smoothly surfaced, the clypeal margin forming the base and the apex on a level with the lower margin of the eye; a shallow punctate furrow from the apex to the occipital margin passing through the anterior ocellus. Antennae attached at the clypeus, at the basal angles of the groove; fairly long, consisting of 10 segments; scape slender but somewhat clavate, not reaching anterior ocellus, pedicel obconic about 4 in the scape, 1st funicle joint about equal to the pedicel, the next two joints about as broad as long, the four following ones a trifle wider than long, club undivided, not quite as long as the three preceding joints, bluntly pointed and bearing short silvery hairs.

Prothorax fairly wide but narrower than the head and mesothorax and rather long, narrowing into a fairly slender neck where the prosternum advances in front of it, the two separated by a costate line; the pronotum rugose and hairy, the neck less so. Mesothorax wider still than the head, wider than long, the mesonotal surface polished in front and behind more or less rugose and hairy with three large shallow pits near the posterior margin, the lateral ones on a line with the parapsidal furrows, which diverge anteriorly, becoming very deep and broad; axillae smooth and shining like the scutellum and separated from this by costate lines, the scutellum having a transverse costate line in front of the hind margin and the suture between it and the postscutellum costate. Propodeum nearly flat, median anterior portion somewhat elevated; a longitudinal carina divides

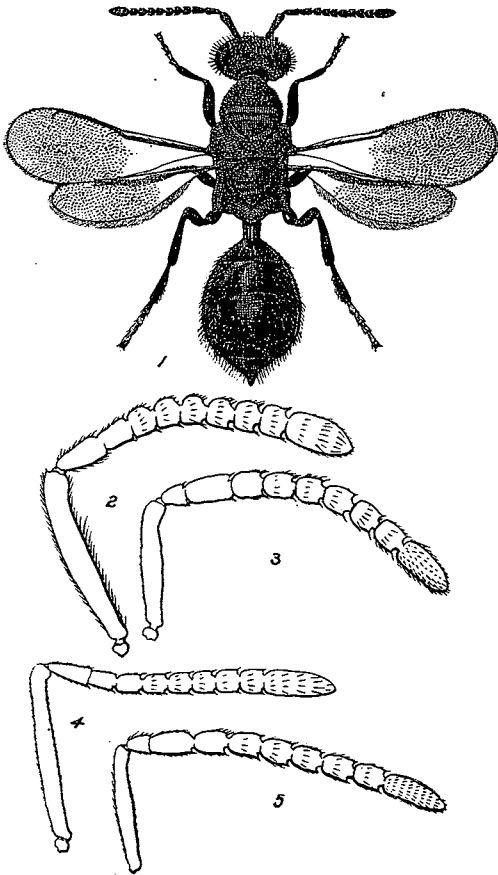


Figure 1, *Spalangia philippinensis*, female; Fig. 2, female antenna; Fig. 3, male antenna. Fig. 4, *Spalangia cameroni*, female antenna; Fig. 5, male antenna.

it, in front passing between two rather large shallow pits and behind flanked on either side by a punctate line or furrow; laterally the pleura are separated by broad shallow grooves; the flat surfaces are partly smooth and shining, but the margins, especially posteriorly, are shallowly rugose; hind angles of the pleura rather sharp.

Abdominal pedicel about twice as long as wide, attached beneath; on the upper surface are half a dozen raised longitudinal lines, between which the surface is finely punctate.

Abdomen broadly oval and convex, smooth and polished; 4th segment the longest, twice as long as the 3rd or 2nd and more than

twice the 5th; following segments still narrower; the 5th, 6th and 7th bearing long silvery hairs on posterior margin which extend anteriorly on the sides even to the first; anterior margin of this segment very deeply indented above the pedicel.

Wings long and narrow; width less than one-third length; the submarginal vein joins the marginal at about the middle; marginal long, more than half the submarginal; stigmal and postmarginal very short, the former with an uncus; disc ciliate outwardly from the junction of submarginal with marginal but basally bare; veins brown.

♂ Head shorter, almost triangular in outline. The pedicel of antennae is shorter than in the female, the 1st funicle joint long, about twice the length of the pedicel, and the other funicle joints all longer than wide, and pedicilate. There is not the large polished area anteriorly on the mesothorax, only a narrow band so polished, although the extent of this area seems to vary. The metathorax is more rugose; the pedicel apparently longer, the 3rd segment narrower in comparison with 2nd as also the 5th and 6th in comparison with 4th.

Differs from *cameroni* in having the antennae stouter, the 1st funicle joint more or less obconic, and shorter club.

DECEMBER 14TH, 1916.

The one hundred thirty-fifth regular and twelfth annual meeting of the Society was held in the usual place, President Illingworth in the chair. Other members present: Messrs. Bridwell, Bryan, Ehrhorn, Fullaway, Giffard, Mant, Muir, Osborn, Pemberton, Potter, Swezey, and Timberlake.

Minutes of previous meeting read and approved.

Mr. Giffard reported that the Trustees of the Hawaiian Sugar Planters' Association had contributed \$250.00 to the financial assistance of the Society.

The committee on "types" reported progress. It was augmented by the appointment of Messrs. Fullaway, Illingworth, and Timberlake.

Report of the Secretary-Treasurer read and accepted.

ELECTION OF OFFICERS FOR 1917.

<i>President</i>	W. R. R. POTTER
<i>Vice-President</i>	C. E. PEMBERTON
<i>Secretary-Treasurer</i>	H. T. OSBORN

ENTOMOLOGICAL PROGRAM.

Corn leafhopper parasites.—Mr. Fullaway reported having reared a Dryinid from the corn leafhopper. He had previously reported having reared all of the sugar cane leafhopper egg-parasites from corn leafhopper eggs, so now he has reared all of the sugar cane leafhopper parasites from the cornhopper. They do not breed nearly so extensively in the latter as they do in the former, however.

Mauna Loa insects.—Professor Bryan exhibited a few insects collected from ice-water pools at the summit of Mauna Loa in August. These were determined by Mr. Swezey as follows:

Hymenoptera

- 3 *Psammochares luctuosus* (Cr.)
- 1 *Limnerium blackburi* Cam.
- 1 Pteromalid.

Odonata

- 1 *Anax junius* Drury.

Coleoptera

- 1 *Scymnus notescens*

Diptera

- 1 *Sarcophaga pallinervis* Thoms.
- 1 *Frontina archippivora* Will.
- 2 *Lyperosia irritans* L.
- 3 *Borborus* sp.
- 6 Small Diptera, 3 species.

Hemiptera.

- 3 *Nysius delectus* White.
- 2 *Nysius* sp.
- 3 Wingless bug (nymph) ?
- 1 Mirid.

Arachnida

- 1 Small spider.

Exhibition of 'Types' of Some Recent Hawaiian Lepidoptera.

BY OTTO H. SWEZEY.

The "types" exhibited are of 41 species of moths described by the writer in recent years. At the times of description no mention was made of the location of the "types". They are now segregated for the purpose of depositing them in the Bishop Museum. None of these species have been hitherto represented in the Museum collections.

Herewith is a list of the species together with references to their descriptions. Those marked with an asterisk (*) have "paratypes" in the author's collection; those marked with a double asterisk (**) have "paratypes" in the cabinets at the Hawaiian Sugar Planters' Association Experiment Station:

<i>Nesamiptis newelli</i>	Proceedings of the Hawaiian Entomological Society, II, 5, Pg. 270, 1913.
<i>Nesamiptis laysanensis</i>	Op. cit., III, 1, Pg. 18, 1914.
<i>Plusia giffardi</i> **	Op. cit., II, 5, Pg. 270, 1913.
<i>Hydriomena giffardi</i>	Op. cit., II, 5, Pg. 271, 1913.
<i>Hydriomena roseata</i> **	Op. cit., II, 5, Pg. 271, 1913.
<i>Genophantis leahi</i> *	Op. cit., II, 3, Pg. 103, 1910.
<i>Cryptoblades aliena</i> **	Bull. Ent. Experiment Sta., H. S. P. A., 6, Pg. 24, 1909.
<i>Omiodes meyricki</i> *	Op. cit., 5, Pg. 24, 1907.
<i>Omiodes musicola</i> *	Proc. Haw. Ent. Soc. II, 2, Pg. 40, 1909.
<i>Omiodes maia</i> *	Op. cit., II, 2, Pg. 74, 1909.
<i>Omiodes anastreptoides</i> *	Op. cit., II, 5, Pg. 272, 1913.
<i>Omiodes fullawayi</i>	Op. cit., II, 5, Pg. 272, 1913.
<i>Omiodes laysanensis</i>	Op. cit., III, 1, Pg. 19, 1914.
<i>Pyrausta thermantoidis</i> **	Op. cit., II, 5, Pg. 273, 1913.
<i>Scoparia lycopodiae</i> *	Op. cit., II, 3, Pg. 104, 1910.
<i>Scoparia nectarioides</i> **	Op. cit., II, 5, Pg. 273, 1913.
<i>Aristotelia gigantea</i>	Op. cit., II, 5, Pg. 274, 1913.
<i>Thyrocopa sapindiella</i> *	Op. cit., II, 5, Pg. 274, 1913.

- Archips fuscocinereus* Op. cit., II, 5, Pg. 275, 1913.
*Archips sublichenoides*** Op. cit., II, 5, Pg. 276, 1913.
Tortrix semicinerana Op. cit., II, 5, Pg. 276, 1913.
*Epagoge urerana** Op. cit., III, 2, Pg. 93, 1915.
*Capua cassia** Op. cit., II, 4, Pg. 183, 1912.
*Capua santalata** Op. cit., II, 5, Pg. 276, 1913.
*Euhypsmocoma ekaha** Op. cit., II, 3, Pg. 105, 1910.
Euhypsmocoma trivittella Op. cit., II, 5, Pg. 278, 1913.
Semnoprepia fuscopurpurea Op. cit., III, 2, Pg. 94, 1915.
*Semnoprepia ferruginea** Op. cit., III, 2, Pg. 94, 1915.
Petrochroa trifasciata Op. cit., III, 2, Pg. 97, 1915.
*Opogona purpuriella** Op. cit., II, 5, Pg. 280, 1915.
*Opogona apicalis** Bull. Ent. Exp. Sta., H. S.
P. A., 6, Pg. 17, 1909.
*Ereunetis penicillata*** Opp. cit., 6, Pg. 13, 1909.
*Gracilaria mabaella** Proc. Haw. Ent. Soc., II, 3,
Pg. 89, 1910.
*Gracilaria hauicola** Op. cit., II, 3, Pg. 106, 1910.
*Gracilaria dubautiella** Op. cit., II, 5, Pg. 278, 1913.
*Gracilaria hibiscella** Op. cit., II, 5, Pg. 279, 1913.
*Gracilaria ureraella** Op. cit., III, 2, Pg. 94, 1915.
*Gracilaria urerana** Op. cit., III, 2, Pg. 95, 1915.
*Philodoria pipturicola** Op. cit., III, 2, Pg. 96, 1915.
*Bedellia oplismeniella** Op. cit., II, 4, Pg. 184, 1912.
*Bedellia boehmeriella** Op. cit., II, 4, Pg. 185, 1912.

New Hawaiian Delphacidae.

BY F. MUIR.

(Read December 14, 1916.*)

During the last twelve months considerable additions have been made to our Delphacid collections, several new species have been captured and our knowledge of the food-plants of many species has been corrected or extended. This has been chiefly due to the energy of Messrs. P. H. Timberlake, O. H. Swezey and W. M. Giffard. Mr. Giffard has also procured a small but interesting collection from the Island of Lanai. This collection was made by Mr. G. C. Munro with the assistance of H. Gibson and it brings the number of species known from that island up to fifteen, and places it third on the list. This indicates that the number of species still unknown from the three larger islands of Kauai, Molokai and Maui is very great.

The new species show the same degree of phallic differentiation as do species previously described, in some cases they are closely related to known forms but in others they appear to be quite isolated. The Hawaiian species of *Kelisia* have been considered as foreign; the four species belong to three distinct types which, without intermediate forms, cannot be conceived as having any relationship. Two species, *K. sporobolicola* and *K. swezeyi*, are closely related, and it is probable that one is of local origin.†. Elsewhere‡ I have put forward the suggestion that this phallic differentiation represents a differentiation of the germ-plasm and, although I have given the subject considerable thought, I can offer no better reason. I believe that one of the first steps in species formation among Hawaiian Delphacidae is a change of food-plant. In many cases this will lead to isolation and may eventually lead to differentiation of the germ-plasm. Mr. W. M. Giffard brought to my notice the fact that certain species feeding upon more than one food-

* The captures, etc., have been brought up to date (February, 1917).

† Since this was written, *K. paludum* Kirk. has been found to have a wide range in the Pacific.

‡ Pro. Haw. Ent. Soc. III, 1916, p. 210.

Proc. Haw. Ent. Soc. III, No. 4, May, 1917.

plant have two or more forms. At Kilauea, Hawaii, *Nesosydne ipomoeicola* is very common on *Lythrum maritimum* H. B. K. and *Sadleria* sp.; specimens from the former plant are on the average much darker than specimens from the latter. In the same locality *N. blackburni* from *Clermontia parviflora* and *Stenogyne* has a distinct green tint when alive which is absent from specimens off of *Pipturus*.

During a recent trip to Kilauea, Hawaii, along with Mr. W. M. Giffard, we hatched out several hundred nymphs of *Nesosydne koae* Kirk. without getting a single egg parasite. We also found evidence that indicated that *N. koae* only oviposits in the young shoots bearing leaves and *N. rubescens* only in the edges of the leaves and phyllodia. Mr. Swezey took the eggs of *N. koae-phyllodii* in the edges of phyllodia. The ovipositor of *N. koae* and *N. rubescens* are quite distinct, the former being smaller, very slightly curved, with about 25-30 fine teeth along the dorso-apical half, the latter is larger, stouter, slightly curved and recurved, with about the same number of larger, square teeth along the dorso-apical half. The ovipositor of *N. rubescens* var. *pulla* is similar to that of the species.

The types of the new species described in this paper, as well as those described in a previous paper,* have been deposited in the collection of the Hawaiian Sugar Planters' Association in Honolulu, T. H.

GENUS LEIALOHA Kirk.

L. lehuae lanaiensis subsp. nov. Pl. V, fig. 1.

♂ Dark brown, antennae, legs and base of abdomen lighter. Tegmina dark fuscous, more intensely so down the middle; apical two-thirds of costal cell (except a dark spot about one-fourth from apex), subcostal cell and a mark in first two apical cells nearly colorless; the clavus, a spot at fork of cubital veins and over the fifth and sixth apical cells lightly fuscous; veins concolorous with membrane, beset with very minute dark granules; wings light fuscous, veins darker.

The genitalia are near to those of the subspecies *kauaiensis*, the crook at apex of aedeagus large, with its apex curved outward.

Length 2.5 mm.; tegmen 3.6 mm.

Hab. Lanai, Kaiholena (G. C. Munro, November, 1916.) This sub-species is closely related to *L. lehuae kauaiensis*.

* Pro. Haw. Ent. Soc. III, pp. 168-221, 1916.

L. lehuae oahuensis Muir.

A long series from various localities from Lanai (Munro, December, 1916). These show the same amount of variation as specimens from Oahu, including the immaculate red female which possibly may be a female form of *L. lehuae lanaiensis*. There is also a form in which the marking in the middle of the tegmen is much more extensive and considerably tinged with reddish brown. Some of these specimens may belong to *L. ohiae* Kirk. as I believe that the division between *L. ohiae* and *L. lehuae* is arbitrary.

L. lehuae hawaiiensis Muir.

Many specimens off *Metrosideros collina polymorpha*, also some nymphs bred to maturity on *Straussia* sp. Kilauea, Hawaii (Giffard and Muir, January, 1917).

Genus NESODRYAS Kirk.

N. antidesmae sp. nov. Pl. V, Fig. 2, 2a.

♂ Slender, as in the typical subgenus. Head and legs white or pale yellow; face and genae between eyes, first segment of antennae and a longitudinal line on second segment black or dark brown, a spot on front coxae and a band at the apex of femora and base of tibiae of middle and hind legs black or dark brown; thorax and abdomen yellow, pronotum lighter than mesonotum, dorsum of abdomen and the pygophor fuscous. Tegmina hyaline, yellowish or light brown at base of clavus and from base of costal cell across to hind margin near apex of clavus, where the otherwise white dorsum is dark brown, veins light except the apical halves of median and cubital veins which are broadly fuscous; margins of apical half of tegmina also fuscous; wings hyaline with light veins.

Pygophor similar in shape to *N. eleocarpae*; anal segment with a pair of stout spines slightly curved and compressed laterally; genital styles similar to *N. eugeniae*; aedeagus straight, cylindrical, slightly larger at base than at apex, apex with a large curved crook on right side and a smaller one on left, a nearly straight spine on ventral side a little before the apex.

Length 2.2 mm.; tegmen 3 mm.

♀ Similar to male; ovipositor dark brown and the pygophor on each side fuscous.

Hab. Nuanu Pali, Oahu (Giffard and Fullaway, November, 1916), six specimens off *Antidesma platyphyllum*.

This species comes next to *N. eugeniae* but is quite distinct, especially in coloration.

N. eugeniae Kirk. Pl. V, fig. 5, 5a.

Four specimens from Kaiholena and Kapano, Lanai (Munro, December). In coloration these conform to *N. eugeniae* of Oahu but the genitalia approaches to those of *N. giffardi*; certain specimens of the latter species from Waiahole, Oahu, have the genitalia approaching to *N. eugeniae* and they both approach to *N. eleaocarpi*. The three species are nearly related and best separated on color.

N. (Nesothoe) dryope (Kirk.)

A series of males and females off *Antidesma platyphyllum* beside the government road Kau, Hawaii, near the Kona boundary. (Giffard and Muir, January, 1917).

N. (Nesothoe) gulicki Muir.

A series of males and females, but no young, off of *Metrosideros polymorpha* Gaud. on the edge of the lava flow near Waia mau, Hawaii, and one nymph bred to maturity off of *Osmanthus sandwicensis*. (Giffard and Muir, January, 1917.)

N. (Nesothoe) terryi (Kirk.). Pl. V, fig. 3.

Two females, one male and a nymph which I consider to be this species, from Waialae Nui, Oahu, (Swezey, April, 1916,) off *Osmanthus sandwicensis* (Gray). The type locality is Waialua, Oahu.

Anal segment with short flattened spines with wide base; genital styles with basal half straight and apical half curved; aedeagus long, thin, tubular, apex pointed, a curved spine from right side, about one-third from apex.

This species comes next to *N. bobeae* (Kirk.).

N. (Nesothoe) piilani (Kirk.). Pl. V, fig. 4.

♂ Vertex, face and genae between eyes and clypeus brown, vertex and genae speckled with light brown, face and genae below eyes sordid creamy white with dirty spots; antennae light brown; pronotum light mottled brown, darker brown on lateral areas and on pleura; mesonotum dark brown between carinae, light brown on

sides; legs yellowish or light brown, fuscous at apex of femora and base of tibiae; abdominal tergites and phygophor brown, sternites dirty white. Tegmina slightly opaque, milky, veins light with distinct dark brown granules somewhat irregular on apical portion, a fuscous band from costal margin near base to junction of claval veins and then to beyond middle of claval margin where there is a darker mark, the basal border of the band fairly well defined but the apical border fading out irregularly; a dark mark at contact between radius and media, and from median cross-vein to apex, more or less indefinite; wings whitish with light veins. The opaque, milky appearance of tegmina and wings due to a waxy secretion and can be removed with chloroform.

Length 3 mm.; tegmen 3.4 mm.

♀ Lighter in color than the male. The band across tegmen is sometimes nearly obsolete, even in males, and the mesonotum between the carinae hardly darker than the sides.

Hab. Kaiholena, Lanai (G. C. Munro, December, 1916), off *Osmanthus sandwicensis* (Gray).

This species was originally described from one female in bad condition from Molokai. The present specimens appear to me to be more distinctly marked and may prove to be distinct, but until male specimens from Molokai can be procured and the genitalia examined I consider it better to place them under the same name. This species comes near to *N. terryi* and *N. bobaeae*.

N. (Nesothoe) maculata Muir.

One female specimen from Kaiholena, Lanai (Munro, December, 1916). Hitherto only known from Hawaii. Common on luma (*Maba sandwicensis* D. C.) along the government road between Kahuku ranch and Kona boundary. Nymphs also bred to maturity on leaves of *Osmanthus sandwicensis*. (Giffard and Muir, January, 1917.)

N. (Nesothoe) fletus (Kirk.).

A series of both sexes from Kaiholena, Lanai, off of *Suttonia* (Munro, December, 1916). Hitherto only known from Maui. In coloration darker and more fuscous than from the type locality. The aedeagus is more acute at apex and the spine at side has a few minute teeth.

N. (Nesothoe) munroi sp. nov. Pl. V, fig. 6.

♂ Face banded black and creamy white; the face and genae between eyes, a band across face and genae one-fourth from apex and a fine line at extreme apex black or dark, shiny brown, the intervening areas creamy white; clypeus fuscous; vertex, pronotum and mesonotum mottled brown, darkest laterad of carinae; antennae black; legs light brown with darker longitudinal markings; abdomen fuscous, lighter on base and on pleura. Tegmina slightly opaque and milky, a sinuous black or dark brown longitudinal mark from base to apex, covering base of clavus, curving to near middle of costa and then toward apex of clavus, irregularly fuscous over base of radius, media and cubitus; veins in base of clavus light with light granules, otherwise veins dark with dark granules irregularly scattered; wings hyaline, slightly fuscous, with brown veins. Anal spines short, flat, broad at base; aedeagus figured.

Length 2.5 mm.; tegmen 3 mm.

♀ Similar to male in coloration; ovipositor dark.

Length 3.7 mm.; tegmen 3.9 mm.

Hab. Lanai 2,000 feet (Munro, December, 1916) on *Dodonaea viscosa* L. (aalii). The nymphs are characterized by the black and white banded face. The aedeagus is a modification of that of *N. dryope*.

Genus *ALOHA* Kirkaldy.

A. campylothecae Muir.

A. kaalensis Muir. Pro. Haw. Ent. Soc. 1916, p. 183. A long series taken by Mr. Timberlake (July, 1916,) shows that there is no good distinction between these two species and so the latter must be sunk.

A. myoporicola Kirk.

Taken on *Pelea volcanica*, Kilauea, Hawaii, adults and nymphs. (Giffard and Muir, January, 1916.)

A. swezeyi Muir.

One male and several females, one of the latter being macropterous, taken on Mount Tantalus off *Campylotheca macrocarpa* (Timberlake, February, 1917). They are of a more uniform brown than the type. One male specimen from Kuliouou, Oahu, off *Lythrum* (Swezey, June, 1916).

Genus NOTHORESTIAS nov.

This genus differs from *Nesorestias* Kirk. by having a single median frontal carina, either simple or furcate. It stands in the same relation to *Nesorestias* Kirk. as *Nesodryas* Kirk. and *Nesosydne* Kirk. do to *Leialoha* Kirk. and *Aloha* Kirk.

N. badia sp. nov. Pl. V, fig. 9.

♂ Antennae reaching to middle of clypeus, first segment more than half the length of second; frontal carina furcate from middle, the two carinae on basal half being near together. Tegmina not reaching to middle of abdomen, reticulate and coriaceous.

Body and tegmina dark brown, darkest over frons and first and second coxae.

Anal segment without spines; genital styles similar to *Aloha ipomoeae* Kirk. but with the "toe" and "heel" more rounded; aedeagus near to that of *Nesorestias filicicola* Kirk., but with the dorso-basal knob reduced to a blunt point, the cock's comb reduced to minute teeth, the spine on right side near apex large, with its apex bent at right angle, the spine on left side stout.

Length 2.5 mm.; tegmen 1 mm.

Hab. Kuliouou, Oahu. (Timberlake, June, 1916.) One specimen swept from ferns.

A female specimen (Swezey, September, 1908,) from Nahiku, Maui, has a simple median frontal carina and forms a second species in this genus.

Genus NESOSYDNE Kirk.

N. pele Kirk.

Nymphs on *Straussia* sp. bred to maturity.

N. timberlakei sp. nov. Pl. V, fig. 14.

♂ Brachypterous, tegmina not reaching to base of pygophor; antennae reaching beyond middle of clypeus, second segment slightly longer than first; frontal carina furcating about one-third from base.

Light brown, darker on head and thorax between carinae and over lateral and posterior portions of abdominal tergites. Tegmina hyaline, light brown, a dark mark at end of costal cell and another at end of cubitus, veins slightly darker with small granules bearing hairs. Anal segment without spines; genital styles curved, slightly flattened, broad at base and narrowing to rounded apex; aedeagus curved dorsad, apex rounded, a row of teeth over apex and along dorso-apical half, four teeth on right side, from the medio-ventral fourth there arises a thin, curved plate with serrated edge.

Length 3.4 mm.; tegmen 2.3mm.

Hab. Oahu, Waiahole. (Timberlake, August, 1916), one male off *Cyrtandra garnotiana*. This species is very distinct but appears to be a development of *N. cyrtandrae* Muir.

N. gunnerae sp. nov. Pl. V, fig. 15.

♂ Brachypterous, tegmina reaching nearly to apex of abdomen; antennae reaching to about middle of clypeus, first segment more than half the length of second; furcation of frontal carina indefinite, about the middle of face.

Light brown or yellowish brown, darker between carinae of head and thorax; front legs with dark tarsi; abdomen dark except the base, an indefinite mark down middle of dorsum and the lateral edges of abdomen lighter. Tegmina hyaline, light brown, veins with minute granules bearing small black hairs, veins dark over the middle third, a small dark mark at apex of costal cell and another at the apex of cubitus, the membrane over middle third slightly infusate. There is considerable variation in coloration, some specimens having the dark areas on tegmina and body more intense and more extensive.

Width of pygophor about equal to depth, ventro-lateral edges produced into rounded process, medio-ventral edge with a minute spine; anal segment short, without spines, medio-apical edge labiate; styles small, narrowing to apex, slightly curved and converging at apex; aedeagus short, slightly flattened laterally, base deep with the stem very strongly curved, apex rounded, orifice on dorsal side near apex, some minute teeth along dorsal surface.

Length 3 mm.; tegmen 2.3 mm.

♀ Similar to male but generally lighter in color.

Length 3 mm.; tegmen 2.3 mm.

Hab. Oahu, Mount Kaala, about 4,000 feet elevation. (Timberlake, July, 1916). A long series of both sexes and one nymph off *Gunnera petaloidea* Gaud., mostly along the midrib on the under side of old leaves. A male and female on *Pelea* sp., one female on *Coprosma longifolia* Gray, and one female on *Suttonia*.

This species comes next to *N. perkinsi* Muir from Maui.

N. nesogunnerae sp. nov. Pl. V, figs. 16, 16a.

♂ Brachypterous; antennae reaching to middle of clypeus or beyond, second joint double as long as the first; medio-frontal carina furcating about middle; vertex longer than broad; first joint of hind tarsus slightly longer than other two together; spur with sixteen teeth on hind edge.

Blackish brown, carinae of head slightly lighter; pleura, legs, base and a medio-dorsal line of abdomen lighter. Tegmina hyaline, ochra-

ceous-tawny, blackish at end of clavus especially so on margin and vein, veins thick, concolorous with membrane, no distinct granules but sparsely beset with black hairs.

Pygophor about as wide as deep; anal spines large, cultrate, slightly diverging; genital styles small, broadest at base and apex, apex truncate with the inner corner slightly produced; aedeagus short, deep, compressed laterally, with a deep emargination about middle of ventral edge, some five or six spines on left side near apex and a longer row on right.

Length 2.9 mm.; tegmen 2 mm.

♀ The female I associate with this species is tawny brown instead of blackish brown, it has sixteen teeth on the tibial spur.

Length 3.9 mm.; tegmen 2.5 mm.

Hab. Lanai, Lanaihale, 3,000 feet elevation (Munro, December, 1916). This species comes between *N. perkinsi* and *N. gunnerae*.

N. disjuncta sp. nov. Pl. V, figs. 12, 12a.

♂ Brachypterous; antennae reaching to middle of clypeus, proportional length of first and second joints as 1 to 1.7; medio-frontal carina furcate at extreme base; vertex longer than broad; first joint of hind tarsi longer than other two together, spur about $\frac{3}{4}$ the length of first tarsal joint.

Head and thorax between carinae dark brown or black, carinae, antennae, lateral margins of pronotum light brown or yellow; legs light brown with longitudinal brown mark on femora; abdomen dark brown with lighter markings on base and in medio-dorsal line near apex. Tegmina hyaline slightly tinged with yellow, lightly fuscous from near base of costal cell to apex of clavus, where there is a dark-brown mark, also a dark mark at apex of costal cell, veins concolorous with membrane with a few minute granules bearing black hairs.

Genitalia as figured. The aedeagus slightly curved with a flange along each side with the edges deeply serrated.

Length 3.7 mm.; tegmen 2.2 mm.

♀ The female I associate with this is slightly lighter in color over the lateral portions of notum and the infuscation from base of costal cell to apex of clavus is very faint. Proportional length of first and second antennal joint as 1 to 2.3.

Length 3 mm.; tegmen 2.3.

Hab. Lanai, male from north end of highest ridge, 3,000 feet, female from Lanaihale, 2,000 feet. This is an isolated species; for the present I shall place it next to *N. perkinsi*.

N. lobeliae Muir.

Aedeagus and genital style figured, Pl. V, figs. 7, 7a.

N. asteliae sp. nov. Pl. V, fig. 13.

♂ Brachypterous, tegmen not reaching to the base of the pygophor; antennae reaching to the middle of clypeus, first segment more than half the length of second; furcation of frontal carina about one-third from base.

Pale yellow, fuscous between carinae of face and clypeus, over lateral portion of abdominal tergites and on hind femora. Tegmina hyaline, fuscous over the middle half. There is considerable variation of color in this species, the abdomen in some specimens being nearly all fuscous and the thorax between carinae, especially of the mesothorax, being fuscous; the tegmina also are nearly black in some and in others the dark marking is confined to a mark at apex of clavus and another at apex of costal cell.

Pygophor about as broad as deep, ventro-lateral edges produced in rounded processes, medio-ventral area bearing a small, blunt spine; anal segment bearing two large, flattened spines slightly sinuous and diverging; genital styles small, slightly curved and slightly narrowed at truncate apex. Aedeagus figured.

Length 3.2 mm.; tegmen 1.8 mm.

♀ Lighter in color, some specimens being almost immaculate; but there is a similar degree of variation as in the male.

Length 3.2 mm.; tegmen 2 mm.

Hab. Oahu, Mt. Kaala (Timberlake, July, 1916), 4,000 feet elevation; a series of males, females and nymphs off *Astelia veratroides* Gaud. This species is very distinct. I consider that it comes next to *N. sharpi* Muir.

N. sola sp. nov. Pl. V, figs. 11, 11a.

♂ Brachypterous, tegmina not quite reaching base of pygophor; antennae reaching to middle of clypeus, first segment more than half the length of second; furcation of frontal carina about middle, the two carinae on basal half being near together and appearing as a single thick carina.

Castaneous, fuscous over lateral portions of abdominal tergites. Tegmina light castaneous, a small fuscous mark at apex of costal cell and another at apex of clavus.

Pygophor deeper than wide, medio-ventral edge produced into a point, medio-lateral edges roundly excavate; anal segment prolonged on ventral edge where it is sublunate, no anal spines; styles very small, slightly curved, apices subacute; aedeagus large, long, tubular, slightly curved, ventral edge of apex produced into two spines, the left larger than the right, dorsal part of apex flattened vertically, a few small spines near apex on ventral side and a couple on right side.

Length 3.2 mm.; tegmen 2.2 mm.

♀ Unknown.

Hab. Oahu, Punaluu (Swezey, June, 1911). This species is very distinct, the aedeagus not being closely related to any of the described species. Along with *N. palustris* it shares the distinction of having the ventral edge of the pygophor produced into a large spine.

N. koebelei sp. nov. Pl. V, figs. 10, 10a.

♂ Brachypterous, tegmina reaching to base of pygophor; antennae reaching beyond middle of clypeus, first segment nearly equal to second in length; frontal carina simple.

Stramineous, fuscous between carinae of head and thorax, and over the sides of abdominal tergites. Tegmina stramineous, veins slightly fuscous, a dark mark at apex of clavus and another at apex of costal cell.

Pygophor wider than deep; anal segment with two short, broad spines, their bases approximate and apices diverging; genital styles broad at base, curved, narrow on apical third, the apices curved and truncate; aedeagus short, flattened laterally, apex subcrassate and bent to the left.

Length 3.6 mm.; tegmen 2 mm.

Hab. Oahu, Punaluu (Swezey, June, 1911). This species is very distinct, but I place it in the vicinity of *N. sharpi*. I name it after Mr. A. Koebele, whose associations with entomological work of our island is well known to local entomologists.

N. blackburni Muir.

One male taken at Punaluu, Oahu, by Swezey (June, 1911). Previously known only from Hawaii.

N. nephelias Kirk. Pl. V, fig. 8.

One male specimen from Lanai, Halelepaakai (Perkins, No. 134, July, 1894), which differs from the description by having the carinae of the same color as the rest of the head and thorax, the femora not striped and the two fuscous marks on tegmina more extensive. The genitalia come near to those of *N. anceps* and *N. swezeyi*.

N. nigriceps sp. nov. Pl. VI, figs. 33, 33a.

♂ Brachypterous; vertex longer than wide, slightly rounded at apex; antennae reaching beyond middle of clypeus, first joint to second as 1 to 1.7; lateral pronotal carinae straight, diverging posteriorly, reaching hind margin; frontal carina forking near base.

Head, pro- and mesothorax and front and middle coxae black, antennae, carinae of clypeus, metathorax and legs ochraceous, a round black spot on metapleura; abdomen black, base, on pleura and a median mark on the hind margin of each tergite yellow. Tegmina ochraceous, a black mark over apex of costal cell and a larger one over middle of tegmen reaching to hind margin at apex of clavus, veins concolorous with membrane, without granules. Genitalia figured.

Length 2.6 mm.; tegmen 2 mm.

♀ There is one specimen which may be the female of this species but the thorax and carinae of head are ochraceous and the black in middle of tegmen not so extensive.

Length 3.1 mm.; tegmen 2.3 mm.

Hab. Lanai, 2,300 feet elevation (Munro, February, 1917). This species comes next to *N. anceps* Muir, but it also shows affinities with *Aloha ipomoeae* Kirk. and *A. myoporicola* Kirk.

N. fullawayi lanaiensis subsp. nov.

The genitalia of this sub-species are similar to those of *N. cyathodis* and *N. fullawayi*. In coloration it is nearer to the latter, but uniformly darker. The tegmina are slightly opaque and milky white with brown veins and granules.

Length 1.7 mm.; tegmen 1 mm.

Hab. Waiopaa, Kaiholena, Lanai (Munro, December, 1916), off *Cyathodes*.

N. raillardiae Kirk.

Numerous on *Raillardia* along government road some three miles from Volcano House, Kilauea. One macropterous female among them. (Giffard and Muir, January, 1917.)

N. hamata sp. nov. Pl. V, figs. 17, 17a.

♂ Brachypterous; vertex longer than wide, medio-frontal carina simple but thick at base; antennae reaching to about middle of clypeus, first joint half the length of second; tibial spur with ten, teeth.

Light ochraceous-buff; between carinae of head and thorax fuscous black; a spot on pleura and a longitudinal mark on femora dark; abdominal segments with darker markings over the lateral areas. Tegmina light ochraceous-buff, a fuscous mark at end of costal cell and another at end of clavus; veins concolorous with membrane; a few minute granules bearing hairs.

Pygophor a little deeper than broad, medio-ventral and lateral edges without projections; anal spines large, bases near together,

slightly diverging towards apex; aedeagus small, with a large barb at the apex; genital styles small, slightly narrowed in middle, apex obliquely truncate, inner corner slightly produced.

Length 2.3 mm.; tegmen 1.5 mm.

♀ The female I associate with this male is similar in color.

Length 3 mm.; tegmen 2.3 mm.

Hab. Lanai, north end of highest ridge, 3,000 feet elevation. This species is isolated; it may come near to *N. palustris* Kirk. of which I have only seen a female.

Genus *KELISIA* Fieber.

The four species of this genus recorded from the archipelago have the face slightly broader and the sides more arcuate than in the type species. The endemism of these insects is doubtful.

K. sporobolicola Kirk. Pl. V, figs. 21, 21a.

Anal segment sunk into dorsal edge of pygophor, spines on ventro-lateral edges large, thick, with blunt apices; genital styles "leg-of-mutton" shape with blunt apex (viewed in situ they appear much more slender; the figure is from specimen mounted in balsam); aedeagus long, thin, tubular, apex acute, orifice on ventral side one-third from apex; from a dorso-median position arises a small serrated crest.

K. swezeyi Kirk. Pl. V, figs. 20, 20a.

Genitalia similar to *K. sporobolicola* Kirk. but the aedeagus more slender, orifice nearer to apex, the dorsal crest replaced by a few teeth, and the genital styles more slender.

Female similar to male, with two distinct black marks on the abdomen, one on each side of the ovipositor near the apex, ovipositor brown.

The type locality is Kalihi, Oahu (Swezey, March, 1906), but recently it has been taken at Nuuanu Pali (Timberlake and Swezey, October, 1916) (Giffard, November, 1916), off *Eragrostis variabilis* Gaud.

K. paludum Kirk. Pl. V, figs. 18, 18a.

Pygophor deeply emarginate on dorsal edge where anal segment is sunk into pygophor; anal spines acute; genital styles short, widest at apex and base, apex truncate; aedeagus small, tubular, basal half larger than apical half, dorsal surface of basal half corrugated. This is very distinct from the former species. Taken by Mr. Fullaway in Laysan Island.*

* Now known from several places in south and southeastern Pacific.

K. emoloa sp. nov. Pl. V, figs. 19, 19a.

Spur tectiform, hind margin with numerous small teeth. Tegmina not reaching to middle of abdomen.

♂ Light brown or stramineous; antennae dark with a longitudinal light mark, legs with longitudinal darker marks; fuscous over the lateral portions of abdominal tergites and sternites; genitalia dark brown. Tegmina stramineous, veins concolorous with membrane, a small dark spot at apex of clavus.

Pygophor subquadrate, lateral edges considerably produced; anal segment sunk into pygophor, each ventro-posterior corner produced into a strong spine with blunt apex; genital styles strongly diverging, strongly bent about middle; aedeagus straight, tubular, with apical portion strongly incrassate and beset with teeth.

Length 2.3 mm.; tegmen 1 mm.,

♀ Lighter in color, slightly infusate between carinae of head and thorax; antennae light with two dark, longitudinal marks, longitudinal marks on legs more distinct; neuration of tegmina lighter than membrane; five more or less distinct light marks down dorsum of abdomen.

Length 3.3 mm.; tegmen 1 mm.

Hab. Oahu, Palolo Valley (Timberlake, July, 1916), Kuliouou (Swezey, June, 1916), off *Eragrostis variabilis* Gaud., which is called by the Hawaiians "emoloa".

Homopterous Notes.

BY F. MUIR.

The material pertaining to these notes forms part of the material collected by members of the staff of the Hawaiian Sugar Planters' Experiment Station during the course of economic work in the Malay and Oriental regions, also material belonging to Prof. C. F. Baker of Los Banos, Luzon, P. I. The types of new species have been placed in the collection of the H. S. P. A. Experiment Station.

The interesting feature of this work has been the finding of several species so widely distributed. *Kelisia paludum* Kirk. hitherto only known from the Hawaiian archipelago is now known from several localities in the south, southwest and west Pacific. *Delphacodes anderida* (Kirk.), which is most likely the same as *Delphax sordescens* Motsch. from Ceylon, is now

* Pro. Haw. Ent. Soc. III, pp. 168-221, 1916.

Proc. Haw. Ent. Soc. III, No. 4, May, 1917.

PLATE V.

- Figure 1. *Leialoha lehuae lanaiensis*, aedeagus.
 2. *Nesodryas antidesmae*, aedeagus; *a*, genital style.
 3. " *terryi*, aedeagus.
 4. " *piilani*, aedeagus.
 5. " *eugeniae*, aedeagus; *a*, genital style.
 6. " *munroi*, aedeagus.
 7. *Nesosydne lobeliae*, aedeagus; *a*, genital style.
 8. " *nephelias*, aedeagus.
 9. *Nothorestias badia*, aedeagus.
 10. *Nesosydne koebelei*, $\frac{3}{4}$ view of pygophor;
 a, aedeagus.
 11. " *sola*, $\frac{1}{2}$ view of pygophor; *a*, aedeagus.
 12. " *disjuncta*, full view of pygophor;
 a, aedeagus.
 13. " *asteliae*, aedeagus.
 14. " *timberlakei*, aedeagus.
 15. " *gunnerae*, aedeagus.
 16. " *nesogunnerae*, aedeagus side view;
 a, end view.
 17. " *hamata*, aedeagus side view;
 a, ventral view.
 18. *Kelisia paludum*, aedeagus; *a*, genital style.
 19. " *emoloa*, aedeagus; *a*, genital style.
 20. " *swezeyi*, aedeagus; *a*, genital style.
 21. " *sporobolicola*, aedeagus; *a*, genital style.
 22. *Anectopia atrata*, pygophor, side view;
 a, genital style; *b*, aedeagus.
 23. *Delphacodes terryi*, pygophor, full view.
 24. " *meridianalis*, pygophor, full view;
 a, aedeagus.
 25. *Phyllodinus sauteri*, aedeagus; *a*, genital style.
 26. *Dicranotropis fuscifrons*, pygophor, full view.
 27. *Perkinsiella pseudosinensis*, pygophor, $\frac{3}{4}$ view.
 28. " *thompsoni*, pygophor, right half, full
 view.
 29. *Phyllodinus punctata*, genital style.
 30. *Perkinsiella fuscipennis*, aedeagus.
 31. " *graminicida*, aedeagus.
 32. " *manilae*, pygophor, $\frac{3}{4}$ view.

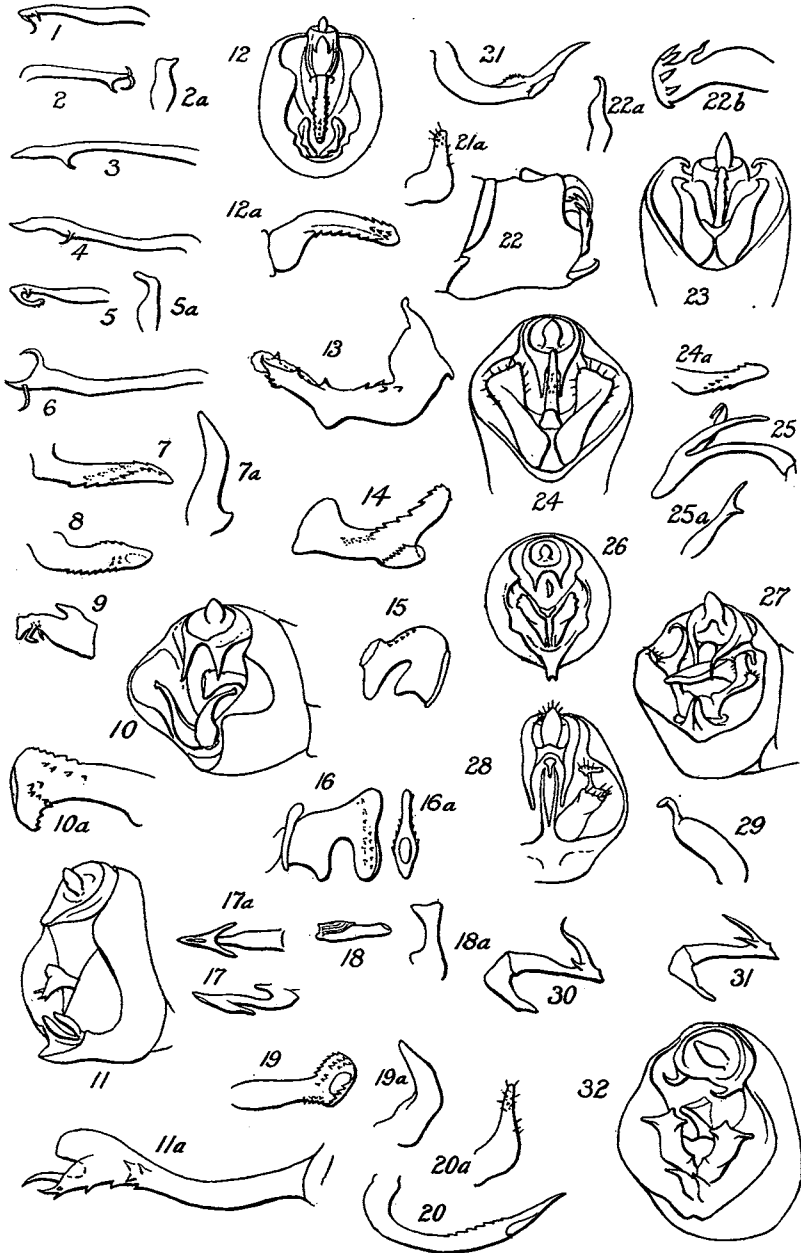
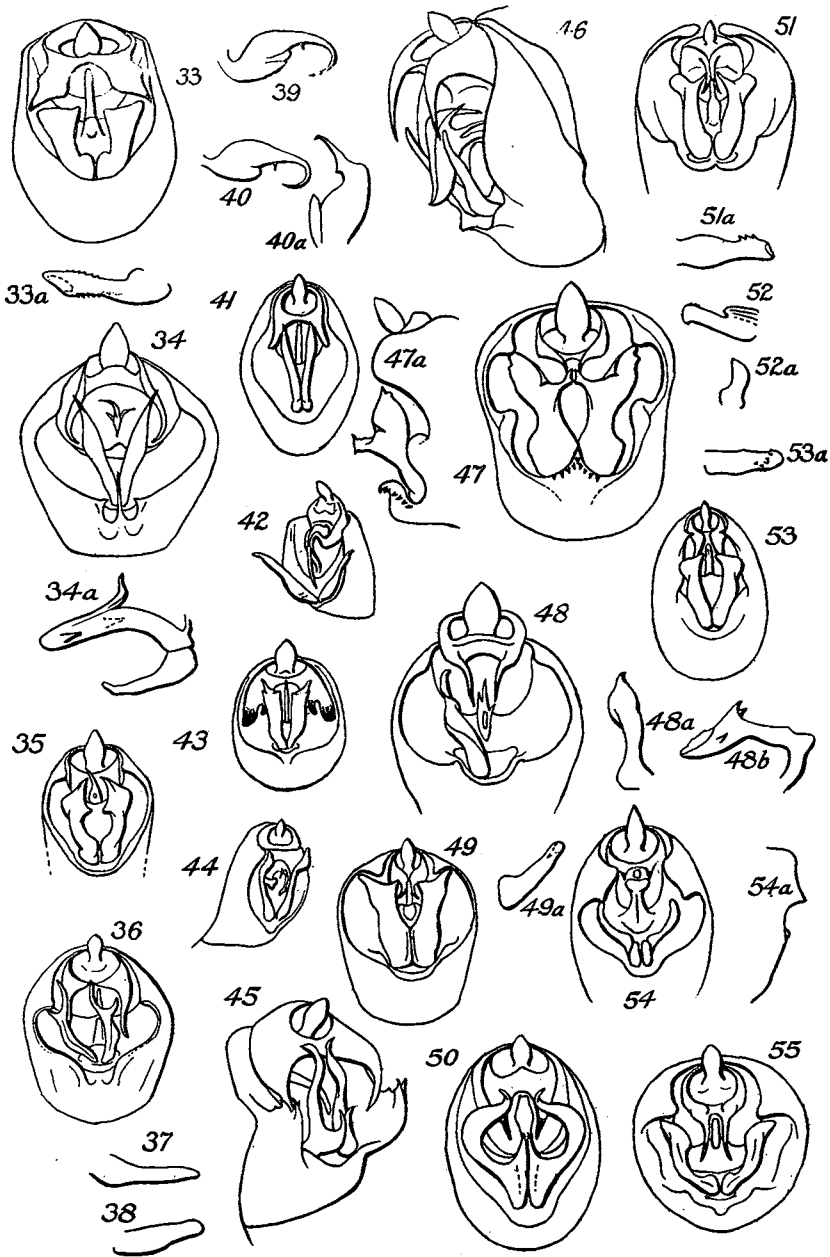


PLATE VI.

- Figure 33. *Nesosydne nigroceps*, pygophor, full view;
a, aedeagus.
34. *Dicranotropis cognata*, pygophor, full view;
a, aedeagus.
35. *Delphacodes anderida*, pygophor, full view.
36. " *cervina*, pygophor, full view.
37. " *propinqua*, aedeagus.
38. " *neopropinqua*, aedeagus.
39. *Stenocranus agamopsyche*, aedeagus.
40. " *philippinensis*, aedeagus;
a, genital style.
41. " *neopacificus*, pygophor, full view.
42. " *nigrifrons*, pygophor, $\frac{3}{4}$ view.
43. " *bakeri*, pygophor, full view.
44. " *taiwanensis*, pygophor, $\frac{3}{4}$ view.
45. " *pseudopacificus*, pygophor, $\frac{3}{4}$ view.
46. *Phyllodinus nigromaculosus*, pygophor, $\frac{3}{4}$ view.
47. *Delphacodes bakeri*, pygophor, full view;
a, side view.
48. *Dicranotropis fuscicaudata*, pygophor, full view;
a, genital style; b, aedeagus.
49. *Kelisia fieberi*, pygophor, full view; a, aedeagus.
50. *Stenocranus luteus*, pygophor, full view.
51. *Sardia brunnia*, pygophor, full view; a, aedeagus.
52. *Kelisia kirkaldyi*, aedeagus; a, genital style.
53. *Delphacodes lactepennis*, pygophor, full view;
a, aedeagus.
54. *Megamelus albicollis*, pygophor, full view;
a, side view.
55. *Delphacodes nigripennis*, pygophor, full view.



known from several spots between Fiji and China. Other species have an equally wide range.

In working over a collection of Delphacidae from different zoological regions one soon notices that there are numerous cases of parallel development, both in structure and coloration, which has no phylogenetic significance. The expansion of the legs in *Asiraca* and *Phyllodinus*, and of the antennae in *Asiraca copicerus*, *Delphax* and *Purohita*, the reduction of both wings and tegmina, are a few such cases in structure. In coloration it would be possible to draw up a long list, of which the following are a few: Light carinae of head and thorax with darker intercarinal spaces; light spots on the face; light pronotum with dark mesonotum; a dark spot on metapleurum; rings and longitudinal marks on legs; a median mark down frons, vertex and thorax; a dark mark at end of clavus and at end of costal cell; these marks are often joined by an ill-defined band; and the "crescent" pattern on apical half of tegmen. This last consists of a mark from costa over cross-veins, along hind apical margin to apex or beyond; this pattern with an increase or decrease of infuscation, with hyaline spots at the end of the apical cells and with the other apical veins also fuscous, forms the markings of a great number of species of which the following list is but a few: *Stobaera concinna*, *Sogatopsis pratti*, *Bambusibatus albolineatus*, *Delphax crassicornis*, *Perkinsiella variegata*, *P. pallidula*, *Phyllodinus macaoensis*, *Anectopia mandane*, *Kelisia fieberi*, *Bakerella maculata*, *Dicranotropis koqbelei*, *D. pseudomaidis*, *Pergandus maidis*, *Delphacodes limbata*.

I cannot account for these cases of parallel development on any utilitarian principal and if I must classify the process it must be under some form of orthogenesis, which may give us a name but not an explanation.

Before the species of the genus *Delphacodes* and its allies can be straightened out it will be necessary to make more use of the genitalia than has been up to the present; not only the pygophor, anal segment and genital styles but also the aedeagus must be used. The last-named organ, I believe, will give us a better idea of relationship than any other single character.

Measurements are made from apex of head to vent, and from the base to the apex of one tegmen; in measuring the tarsal joints I have taken from the base of the first joint to the base of the second joint and then to the apex of the third joint, thus the spines at the apex of the first joint are not included in the length of that joint.

DELPHACIDAE.

Genus DICRANOTROPIS Fieb.

D. fuscifrons (Muir). Pl. V, fig. 26.

Perkinsiella fuscifrons Muir, H. S. P. A. Ent. Bull. 9, (1910), p. 11.

This was originally described from a single female. I now have males and females from the same locality. The second segment of the antenna is cylindrical. It comes next to *D. pseudomaidis** (Kirk.).

D. koebelei (Kirk.).

Formerly known from Fiji, Queensland, Philippines and Java, now known from Borneo, New Guinea and Ceram Island.

D. muiri Kirk.

One male specimen from Formosa (Muir, January, 1916); Luzon, Los Banos (Baker coll.). Formerly known from China, Java and Borneo.

D. cognata sp. nov. Pl. VI, figs. 34, 34a.

♂ Brachypterous; tegmen reaching to base of seventh abdominal segment, neurulation normal. Length of vertex equal to the width at base; medio-frontal carina forking level with lower margin of eyes; antennae reaching near to the middle of clypeus, cylindrical; lateral carinae of pronotum divergently curved, not reaching hind margin; front and middle tibiae and femora not flattened; length of first joint of hind tibia equal to the other two together, spur slightly longer than first tibial joint, broad, laminate, many minute teeth on hind margin.

Ochraceous-tawny, a few very faint spots on face, the apex of first and base of second antennal joint dark, carinae of thorax slightly

* In H. S. P. A. Ent. Bull. III, on page 136 fourth line from end read Plate XIII for Plate XII.

lighter, a round, brown mark on metapleura, abdomen dark on lateral portions, pygophor and styles dark brown. Tegmina hyaline, light ochraceous, a black mark covering the apical cells, veins concolorous with membrane, without granules. The genitalia figured.

Length 2 mm.; tegmen 1.3 mm.

♀ One female from Baguio which I associate with this species is of a uniform liver brown.

Length 2.5 mm.; tegmen 1.4 mm.

Hab. Queensland, Cairns and Brisbane (Perkins and Koebele, 1904); Fiji, Rewa (March, 1906, Muir); Luzon, P. I., Benguet, Baguio (Baker), Mount Benahao (Muir).

With the exception of the normal legs and neururation of tegmina this species shows close affinity with *Phyllodinus nigromaculosus* Muir and its allies. It is probable that the species of the genus *Phyllodinus* are polyphyletic.

D. fuscicaudata sp. nov. Pl. VI, figs. 48, a, b.

♂ Light buff, pygophor and styles fuscous brown. Tegmina light buff, opaque with a thin waxy secretion, veins concolorous with membrane, granules minute and concolorous with veins; wings hyaline, veins yellowish. Genitalia figured.

Length 2 mm.; tegmen 2.6 mm.

♀ The female I place with this species is brachypterous and also uniformly light buff.

Length 2.6 mm.; tegmen 1.3 mm.

Hab. Luzon, Los Banos (Muir, September, 1915). This uniformly colored species is easily recognized by the male genitalia.

D. cervina sp. nov. Pl. VI, fig. 36.

♂ Length of vertex equal to width at base, apex slightly narrower than base, carination of the usual *Dicranotropis* type but the median carina nearly obsolete; length of face nearly twice the width, sides subparallel sided except at base between the eyes, where it is slightly narrowed, median carina forking slightly before lower margin of eyes; antennae reaching to the middle of clypeus, second segment nearly twice (1.9) the length of first; hind tarsus a little shorter than tibia, first tarsal joint 1.5 times the length of the other two together, spur about two-thirds the length of first joint, moderately wide, with about 25 small teeth on hind margin; lateral pronotal carinae divergently curved, not reaching hind margin of pronotum.

Burnt sienna or light chestnut, four pair of lighter spots on frons, carinae and some spots on the lateral portion of pronotum lighter; abdomen chestnut brown, lighter on pleura, the hind margin of some segments and a narrow mark down middle, genital styles dark brown.

Tegmina hyaline slightly tinged with ochraceous, veins to cross-veins light ochraceous, apical portion fuscous, granules small, con-

colorous with veins, a fuscous mark on hind margin at apex of clavus.

Length 2.7 mm.; tegmen 3.4 mm.

♀ The two specimens of females that I place with this species are similar in build but slightly darker in color, the neuration of tegmen being fuscous from base to apex. The pygophor is dark but the lateral plates light.

Length 2.8 mm.; tegmen 3 mm.

Hab. Luzon, Los Banos (Muir, September), one male and two females.

Genus PHYLLODINUS V. D.

P. nigromaculosus sp. nov. Pl. VI, fig. 46.

♂ Head as wide as thorax; vertex wider than long; medio-frontal carina forking near middle; antennae reaching to middle of clypeus or beyond, second segment slightly clavate; first and second femora and tibiae distinctly flattened but not so wide as in *P. nervatus* V. D.; tegmina reaching to pygophor.

Dark brown; lateral areas of pronotum, carinae of head and thorax, second joint of antennae, spots on frons, base and apex of femora and tibiae, hind tarsi and along hind tibiae, base of abdomen and anal tube lighter brown or yellowish. Tegmina hyaline, very light brown, fuscous over apical area, veins white with distinct black granules each bearing a white hair.

Pygophor short dorsally, long ventrally, aperture longer than broad, medio-ventral edge forming a small quadrate lip; anal segment large, with a long, curved spine at each apical corner; styles long, thin, diminishing to apex, slightly sinuate; aedeagus complex, thin at the base, the apex forming a large barb with the corners projecting basad, that on the left forming a curved spine, that on the right a longer and thinner spine with a shorter one near base.

Length 2 mm.; tegmen 1.4 mm.

♀ Similar to male in coloration.

Length 2.7 mm.; tegmen 1.7 mm.

Hab. Luzon, Los Banos (type, Muir, September, 1915), Mt. Maquiling (Baker) very light in color; Papua, Laloki River (Muir, 1909) slightly lighter in color than the type, otherwise typical.

P. sauteri sp. nov. Pl. V, figs. 25, a.

♂ This species is similar to *P. nigromaculosus* Muir except in the genitalia. Medio-ventral edge of pygophor with very small lip, lateral edges produced below anal segment and partly embracing it, spines on anal segment small; genital styles small with a small prong on outer edge near apex; aedeagus also differing from *P. nigromaculosus*.

Length 2 mm.; tegmen 1.4 mm.

Hab. Formosa, Daimokko (Muir, Sauter, January, 1916), swept from grass.

P. punctata sp. nov. Pl. V, fig. 29.

♂ Except in genitalia this species is structurally the same as *P. nigromaculosus* Muir. Color also similar except that the vertex, thorax between carinae and lateral margins light brown, thorax laterad of carinae dark brown; frons, clypeus and antennae fuscous, frons with light spots.

Medio-ventral edge of pygophor produced into a small quadrate plate wider than long with the apical margin roundly emarginate, lateral margins of pygophor slightly sinuous; apical corners of anal segment each with a long, thin, curved spine; genital styles broad on basal two-thirds, apical third thinner and twisted; aedeagus with spine on right side small, acute, left side longer, curved.

Length 2 mm.; tegmen 1 mm.

Hab. Formosa, Daimokko (Muir, January, 1916). Swept from grass.

P. luzonensis Muir has the first and second pair of femora and tibiae much wider and more foliaceous than in *P. nervatus* V. D. and I think it represents *Platybrachys* Bierman. The latter name is preoccupied in *Heteroptera* (Stål, 1860) but as it is likely to be a synonym I refrain from creating a new name.

GENUS *SMICROTATODELPHAX* Kirk.

S. kirkaldyi sp. nov.

♂ Testaceous; abdomen, with the exception of the base and pleura, fuscous. Tegmina light testaceous, veins concolorous with membrane with a few minute granules; margins of tegmina slightly incrassate and lighter in color.

Pygophor about as wide as deep, dorsal edge deeply emarginate where the anal segment is sunk into it, the corners of the emargination simple, not produced or turned down; anal segment small, ventral edge of apex produced into a small point turned ventrad; genital styles very similar to *S. perkinsi*.

Length 1.3 mm.; tegmen .6 mm.

Hab. Java, Roban (Muir, 1907); one male swept from grass.

This is very close to the type species but the shape of the pygophor makes it easily recognizable. Kirkaldy's measurements of *S. perkinsi* is given as 1½ mill. but the true meas-

urement is the same as this species. They are the smallest Delphacids I am acquainted with.

GENUS *STENOCRANUS* Fieb.

Some of the species under this genus appear to belong to *Sogata* Distant, but until I can examine the type species (*S. doughertyi* Dist.) I cannot place them correctly, as some of the critical characters of this and other genera are omitted in Distant's descriptions and figures.

S. bakeri sp. nov. Pl. VI, fig. 43.

S. pacificus Muir not Kirk., Phil. Jour. Sci. 1916, Sec. D, vol. xi, No. 6, p. 382.

♂ Width of head including eyes to length of head and thorax 1 to 1.90; width of face to length 1 to 2.90; first segment of antenna to second as 1 to 2. Spur with many (25-30) small teeth on hind margin. Vertex longer than wide, base wider than apex; sides of face nearly straight, base slightly narrower than apex.

Buckthorn brown (Ridgway standard), a white median line down head and thorax, blackish on face between carinae, a small black spot on mesopleurum, claws and spines on legs black; abdominal tergites ochraceous orange, anal spines fuscous. Tegmina hyaline, slightly tinged with buckthorn brown, darker over clavus, claval margin whitish, veins darker, granules very minute; wings hyaline, veins brown.

Apical corners of anal segment produced into wide, apically rounded plates with a small, slightly curved, blunt spine at their inner base; genital styles truncate at apex with an acute process arising from the hind margin of apex; aedeagus simple, slender, slightly curved.

Length 2.5 mm.; tegmen 3.6 mm.

♀ Unknown.

Hab. Luzon, Los Banos, on grass (Baker, Muir), Baguio, Benguet (Baker coll.).

S. neopacificus sp. nov. Pl. VI, fig. 41.

♂ In structure similar to *S. bakeri*, the first joint of antenna a little longer in comparison with second (1 to 1.70). In color similar to *S. bakeri* but the white line down thorax and vertex continued down frons. Anal spines broad, obtusely pointed; genital styles simple, apex acute, narrow, a small knob at base; aedeagus tubular, thin, with three small curved spines about middle of dorsal surface.

Length 2.8 mm.; tegmen 4 mm.

♀ The groove down pygophor narrow, posterior edge of pygophor slightly emarginate; lateral plates narrow, subequal in width, except at base where it is narrower, apical margin deeply emarginate, leaving the corner projecting; ovipositor sheaths narrow. Similar in color to male.

Length 3.6 mm.; tegmen 5 mm.

Hab. Amboina (type); Papua, Laloki River (Muir). This is the simplest form of the Malay species that I have studied.

S. nigrifrons sp. nov. Pl. VI, fig. 42.

♂ Width of head including eyes to length of head and thorax 1 to 1.6; width of face to length 1 to 2.5; first joint of antenna to second 1 to 2.4; otherwise structurally as in *S. neopacificus*. Thorax buckthorn brown, carinae of face and a median mark down thorax and vertex lighter; face between carinae, genae below eyes and clypeus between carinae black; a minute black spot on pleurum; spines on legs and teeth on spur black; abdomen ochraceous orange, genital styles brown. Tegmina hyaline, light buckthorn brown, darker over clavus, veins darker with minute granules, claval margin whitish; apical veins blackish spreading into fifth and sixth apical veins.

The apical corners of anal segment are brought together making segment diamond shape, the spines long, thin, ensate and curved; aedeagus curved, ensate, slightly flattened laterally, resting between the anal spines.

Length 2.6 mm.; tegmen 3.5 mm.

♀ Much darker than male, the abdomen nearly all black, tegmina darker with most of the veins blackish. Ovipositor sheaths narrow, laterally flattened on apical half; groove narrow; lateral plates small, inner margin arcuate, entire.

Length 3.6 mm.; tegmen 4 mm.

Hab. Formosa, Kanshirai (Muir, 1916), swept from reeds.

S. pacificus Kirk.

♀ Lateral plates about one-fourth length of pygophor, narrow, edge emarginate at middle, the plate elevated at that point.

S. agamopsyche Kirk. Pl. VI, fig. 39.

♀ Lateral plates of female nearly half the length of pygophor, narrow, margins entire.

S. pseudopacificus Muir. Pl. VI, fig. 45.

Male genitalia figured, female with apical edge of pygophor medianly emarginate, latero-apical portions forming small, blunt, conical projections; ovipositor sheaths narrow; lateral plates reach-

ing about one-third along pygophor, basally wide, apically graduating to a point, a deep emargination near base.

S. philippinensis sp. nov. Pl. VI, fig. 40.

♂ Antennae reaching slightly beyond base of clypeus, second joint 3.2 times the length of first; first joint of hind tarsus as long as the other two together, spur as long as first joint, wide, laminate, with minute teeth along hind margin.

Ochraceous-buff, fuscous or black between the carinae of head and slightly so on the pronotum, a round black spot on lateral margin of pronotum, slightly fuscous between the carinae of mesonotum, legs darker ochraceous with a longitudinal mark on femora, more distinctly so on hind femora; abdomen dorsally dark, lighter at base and along middle, pygophor and styles dark brown. Tegmina hyaline, veins colorless on basal half, brown on apical half.

Length 3 mm.; tegmen 3.6 mm.

♀ Unknown.

Hab. Luzon, P. I., Mount Maquilung. This is a Philippine form of *S. agamopsycha* Kirk. of Queensland. The form of the pygophor is similar but the genital styles are distinct and it has a distinct black spot on the side of the pronotum.

S. ? taiwanensis sp. nov. Pl. VI, fig. 44.

♂ Length of vertex equal to width, projecting slightly in front of eyes, apex slightly arcuate, base slightly wider than apex, carination similar to that of *Delphacodes*; lateral pronotal carinae straight, slightly diverging, reaching hind margin; width of head including eyes to length of head and thorax 1 to 2.1; width of face to length 1 to 1.7, very slightly narrower at base than at apex, median carina unforked; antennae reaching to apex of face, length of first joint to second 1 to 4, first joint as broad as long. Spur cultrate, concave on inner side, an apical tooth but no teeth on hind margin.

Ochraceous-orange dorsally, yellow-ocher ventrally, chocolate or black slightly over vertex and middle of pronotum, darker over most of the mesonotum, tegulae, the five median abdominal tergites and the genital styles. The dark markings very variable, in some specimens almost absent. Tegmina hyaline, ochreous, veins darker with exceedingly minute granules, clavus and cubital cells light brown, a dark mark on claval border near base and another near apex.

Opening of pygophor ventrally oblique; no spines on anal segment; aedeagus short, strongly curved, basal half deep, apical half thin, tubular, a strong curved spine from near the middle of left side along side of aedeagus to near apex, at its base a small spine standing at right angle to aedeagus.

Length 2.3 mm.; tegmen 3.5 mm.

♀ Similar to male. Pregenital plate distinct, quadrate, deeply emarginate to near base; lateral plates small, reaching about one-

third from base of pygophor, inner edge arcuate, entire. Pygophor large, wide, median depression large, posterior margin roundly emarginate; ovipositor sheath narrow, compressed laterally on upper half.

Length 3.8 mm.; tegmen 4.1 mm.

Hab. Formosa, on reeds (Muir, January, 1916). By the tibial spur this should come into the Tropidocephalini. It may belong to one of Mr. Distant's Indian genera but I leave it in its present position until I have fuller knowledge.

S. ? luteus sp. nov. Pl. VI, fig. 50.

♂ Length of vertex, pro- and mesonotum one and one-half the width of head including eyes; length of vertex one and one-half the width of base, base broader than apex; length of face two and one-half the width of apex, base narrower than apex, lateral edges straight; antennae reaching nearly to middle of clypeus, second joint 1.75 times the length of first; lateral pronotal carinae straight, diverging, not quite reaching to the hind margin of pronotum; basal joint of hind tarsus slightly longer than the other two together, spur as long as basal tibial joint, wide, laminate, with many fine teeth on hind margin.

Capucine orange, vertex, frons and antennae slightly fuscous, an indefinite whitish mark down the middle of mesonotum. Tegmina and wings hyaline, very slightly yellowish, veins concolorous with membrane, a few minute concolorous granules on tegminal veins. Genitalia figured.

Length 2.2 mm.; tegmen 3 mm.

♀ The female I place with this species has the antennae a little shorter. The pygophor is long and narrow, ovipositor laterally compressed on apical 3/5; lateral plates two-fifths along ovipositor, edges entire, at base slightly produced and touching in the middle line.

Hab. Amboina, two males and one female (Muir). This species may belong to *Sogata*, it is not typical of *Stenocranus*.

Genus PERKINSIELLA Kirk.

Perkinsiella manilae sp. nov. Pl. V. fig. 32.

♂ Light brown or yellow; face between eyes, antennae, clypeus with the exception of the apex, a fine line across apex of face, lateral portions of pro- and mesonotum, first and second coxae, a spot on metapleurum, longitudinal lines on femora, two bands on first and second tibiae, first and second tarsi, and the abdomen with the exception of basal tergite, dark brown; face between eyes with small, light spots. Tegmina hyaline, brown, darkest over apical third, lighter brown or clear hyaline over costal, subcostal, and a triangular mark in radial apical cells; veins concolorous with membrane, granules very minute with dark hairs, hind margin of clavus white;

wings hyaline with brown veins; spur on hind tibia slightly darker than leg.

Medio-ventral edge of pygophor with two small, laterally flattened spines; anal spines small, bent backward from near base; genital styles short, broad, flattened, sides subparallel, apex subtruncate, each apical corner produced into a small, subquadrate process with their corners produced into small points.

Length 3.5 mm.; tegmen 4.7 mm.

Female unknown.

Hab. Luzon, Manila (C. R. Jones), Bureau of Science, No. 14525.

In the table of the Philippine species of this genus* this species comes next to *P. saccharivora* Muir, but the genitalia are near to *P. saccharicida* Kirk. This is the nineteenth species of this genus, and the seventh recorded from the Philippines.

P. graminicida Kirk. Pl. V, fig. 31 Aedeagus figured.

P. fuscipennis Muir. Pl. V, fig. 30. Aedeagus figured.

P. thompsoni Muir. Pl. V, fig. 28. Genitalia figured.

P. pseudosinensis Muir. Pl. V, fig. 27. Genitalia figured.

Genus *Pissonotus* Van Duzee.

P. pylaon (Kirk.).

"*Delphax*" *pylaon* Kirkaldy, 1907, H. S. P. A. Ent. Bull. III, p. 160, Pl. XV, figs. 12-14.

Originally described from Queensland. I have a long series of males, all macropterous, and a short series of females, both macropterous, and brachypterous, from Formosa, also two specimens from Luzon, P. I., and one from Java. The lateral pronotal carinae are straight or but very slightly divergingly curved, and reach near to the hind margin. The first joint of the hind tibia equal to the two other together; spur slightly shorter than first tibial joint, laminate, moderately wide, with numerous small teeth on hind margin; width of head, including eyes, double the length; antennae reaching to about middle of clypeus, first joint slightly more than half the length of second (1 to 1.9). I place it in this genus provisionally, the spur is not of the *Pissonotus* type.

* Philippine Journal Science, xi, Sec. D. No. 6, p. 378, 1916.

Genus ANECTOPIA Kirk.

A. mandane Kirk.

Mestus morio Melichar not Motsch.?

Thanks to the kindness of Dr. Melichar, I have a male specimen of the species described and figured by him* under this name. I have not seen Motschoulsky's original description and figure, only Distant's translation. It is with great diffidence that I question the correctness of our leading Homopterist's identification of this insect; it does not agree with Motschoulsky's generic characters of *Mestus* but it is the same as *A. mandane* Kirk. Only an examination of *Motschoulsky's* type can decide this identification; should Dr. Melichar be correct then *Anectopia* Kirk. must fall to *Mestus* Motsch. In Kirkaldy's figures† the carinae of vertex and thorax are too distinct and the lateral pronotal carinae should not distinctly reach the hind margin. The habitat of this species will now be Queensland and Ceylon. That it will be found in other parts of the Austro-Malayan region I feel quite sure.

A. atrata sp. nov. Pl. V, figs. 22, 22a, 22b.

♂ Bachypterous. Vertex as long as broad, not quite so wide as the thorax; antennae reaching to near the middle of clypeus, second joint nearly twice the length of first; carinae not distinct; medio-frontal carina simple; lateral carinae of pronotum divergently curved, not reaching to hind margin; tegmina reaching to base of pygophor; hind tarsi short, first joint not quite so long as the other two together, spur as long as first joint, laminate, hind margin without teeth.

Black or blackish brown, legs lighter brown; tegmina shiny black or blackish brown, veins with minute granules bearing black hairs.

Length 2 mm.; tegmen 1.5 mm.

Macropterous; one male similar in color to the above but having the tegmina colorless hyaline, with the veins light brown with minute granules.

Length 2 mm.; tegmen 2.7 mm.

♀ Similar to the male.

Length 2.6 mm.; tegmen 1.8 mm.

Hab. Luzon, P. I., Baguio (Baker coll.). The genitalia have an affinity with *A. mandane*, but the sides of the face

* Hom. Faun. Ceylon, Melichar 1903, p. 105, Pl. II, fig. 15.

† H. S. P. A. Ent. Bull. III, Pl. XI, figs. 11, 17 (1907).

are less arcuate. This species may be the same as *A. igerna* Kirk. described from a female.

Genus MEGAMELUS Fieber.

M. proserpina Kirk.

Originally described from Fiji but I now have specimens from Queensland, Amboina, Java, and Luzon, P. I.

M. proserpinoides sp. nov.

♂ Macropterous. In build and coloration this species is similar to *M. proserpina* Kirk. but the genitalia are distinct. Instead of the three flat flanges on the ventral edge of the pygophor there are three conical processes, the median one the largest; the apical portion of the genital styles is not so curved and the apex is truncate; the anal spines are closely appressed at their bases.

Length 2.6 mm.; tegmen 2.8 mm.

♀ The females I cannot distinguish from *M. proserpina*.

Length 2.9 mm.; tegmen 3 mm.

Hab. Davao, Mindanao, P. I. One male and one female (Baker coll.).

M. albicollis sp. nov. Pl. VI, figs. 54, 54a.

♂ Length of vertex one and one-half the width; length of face 2.2 times the width, widest in middle, sides slightly arcuate, median carina not forked; antennae reaching to the middle of clypeus, second segment 1.6 times the length of first; lateral pronotal carinae straight, slightly diverging, reaching hind margin of pronotum; first joint of hind tarsus equal in length to other two together, spur not quite so long as first tarsal joint, moderately wide, laminate, hind edge with minute teeth; brachypterous.

Intercarinal spaces of face, genae and clypeus black or fuscous brown, vertex, antennae, sides of clypeus, legs and carinae of face and clypeus ochraceous, the median frontal carina wider and whiter than the others; brown over coxae; pronotum white or creamy white, mesonotum brown, darkest between carinae; abdomen ochraceous, brown over median portion of tergites and on some sternites, also the genital styles and ventral half of pygophor brown. Tegmina brown with a darker spot at the end of clavus; hind margin to spot at end of clavus, a small mark beyond that spot and the costal margin white; granules exceedingly minute and sparse.

Genitalia figured. A noticeable point is the great development of the process on the diaphragm below the aedeagus.

Length 1.9 mm.; tegmen .9 mm.

Hab. Luzon, Mount Benahao (Muir), described from a single male.

M. (?) furcifera (Horv.).

Delphax furcifera Horvath, 1899, Terms. Fuzetek, XXII, p. 372.

Delphax kolophon Kirkaldy 1907 H. S. P. A. Ent. Bull. III, p. 159, Pl. XV, figs. 9, 10, 11.

The vertex of this species is longer than broad with the apex slightly narrower than the base. It is not congeneric with *Delphacodes mulsanti* Fieb., neither is it strictly congeneric with *Megamelus notulus* (Germar), but I think it is better placed with the latter than with the former.

I have specimens of this species from Fiji, Amboina, Ceram, India, Philippines, South China (Lo-fu-shan, 3,000 feet), Formosa and Japan. They may eventually be divided into two subspecies as the Philippines and Indian species differ somewhat from the type.

M. geranor (Kirk.).

"*Delphax*" *geranor* Kirkaldy, 1907, t. c. 158.

M. kaha (Kirk.).

"*Delphax*" *kaha* Kirkaldy, 1907, l. c.

M. leimonias (Kirk.).

"*Delphax*" *leimonias* Kirkaldy, 1907, t. c. 159.

Genus *SARDIA* Melichar.*S. pluto* (Kirk.).

One male specimen from Formosa (Muir, December, 1916), previously known from Fiji, Queensland and the Philippines.

S. brunnia sp. nov. Pl. VI, figs. 51, 51a.

♂ Vertex longer than width of base, apex about half the width of base; medio-lateral carinae meeting before the apex; lateral pronotal carinae diverging, slightly curved, not reaching hind margin; in profile the head not projecting so far, or the medio-frontal carina so prominent, as in the type species; antennae reaching to about middle of clypeus, first joint half the length of second; first hind tarsal joint as long as the other two together, spur longer than first tarsal joint, broad, laminate, with minute teeth on hind margin.

Shiny warm blackish brown; antennae, apical portion of clypeus, rostrum and legs ochraceous, genital styles light brown; tegmina and

wings warm blackish brown with darker veins, veins of tegmina with small brown granules. Genitalia figured.

Length 1.9 mm.; tegmen 2.5 mm.

Hab. Amboina (type, Muir); Luzon, Pagsanhan, P. I. (Baker coll.). In the Philippine specimen the carinae of frons considerably lighter.

S. rostrata Dist.

Four females from Los Banos, Luzon (Muir, September, 1915), which are like the specimens from Borneo which I referred to this species.

Genus *KELISIA* Fieber.

K. kirkaldyi sp. nov. Pl. VI, figs. 52-a.

"*Delphax*" *puella* Kirkaldy not Van Duzee* (1907), H. S. P. A. Ent. Bull. III, p. 160. Pl. XV, figs. 1-3; Muir, Philippine Jour. Sci. XI, Sec. D, No. 6, p. 385, 1916.

♂ Macropterous. Vertex a little longer than the width of base, apex slightly narrower than base; frons narrowest at base between eyes, sides slightly arcuate, median carina simple; antennae reaching to base of clypeus, first joint slightly more than half the length of second; lateral pronotal carinae not divergently curved, straight, diverging, not quite reaching hind margin, or if they do they are slightly convergently curved near hind margin; first joint of hind tarsus not quite so long as the other two together, spur longer than first tarsal joint, wide, laminate, with numerous minute black teeth on hind margin.

Head, anterior third of pronotum, mesonotum, coxae and most of thoracic pleura shiny black or blackish brown, lateral carinae of face, the triangular space between carinae at apex of vertex, carinae of clypeus, all the pronotum except a narrow anterior margin and the posterior angle of mesonotum white or light creamy white, apex of first antennal joint and most of second joint light brown; legs light brown, femora darker than tibiae; abdomen dark brown, light over base and on pleura. Tegmina hyaline, slightly opaquely white, veins light with very minute granules, margins darker, especially the apical margin, a dark brown spot on margin at apex of clavus; wings hyaline with light veins. Opening of pygophor deeper than wide, a deep anal emargination on dorsal edge, rest of margin entire, simple; anal spines contiguous at base, divergently curved to apex; styles small, their bases generally concealed within the pygopher so that they appear curved and acute, but dissected out and viewed flat they appear as in Pl. VI, fig. 52a; aedeagus slightly crassate at apex with three minute spines in a dorso-apical position, base with a dorsal

* See remarks under *Delphacodes puella*, p. 337.

enlargement which has one or two longitudinal corrugations along it. Length 1.6 mm.; tegmen 2 mm.

Brachypterous form similar to above but the tegmina only reaching to the eighth abdominal segment, white or creamy white over base and along apical margin, fuscous over median portion. Length of tegmen 1 mm.

♀ Similar to male. Macropterous forms 1.9 mm. long, tegmen 2 mm.; brachypterous forms 1.9 mm. long, tegmen 1 mm.

Hab. Fiji (type, Muir, Koebele); Queensland (Koebele, Perkins); Luzon, Los Banos (Baker, Muir); Formosa (Muir). This species is a near ally of *K. paludum* Kirk.

K. paludum Kirk. Pl. V, figs. 18-a.

This species was described by Kirkaldy from specimens taken on Oahu, Hawaiian Islands, and afterward taken by D. T. Fullaway in Laysan Island to the northwest. I now find specimens among our material from Fiji, Queensland, Java, Ceylon and the Philippines. The genitalia of specimens from these widely separated localities are similar but the coloration varies. The prevailing color of the Hawaiian specimens is brownish yellow with a variable amount of infuscation on the face between the carinae and over the abdomen; there is a tendency for the mesonotum to darken and for a tinge of fuscous to appear over the claval and cubital cells. Among the nine specimens from Rewa, Ba and Navua, Fiji, the color is darker (except the pronotum and carinae of head) especially the mesonotum which is dark and shiny in some specimens; in the two Queensland specimens, the one from Pekalongan, Java, the one from Ceylon and the five specimens from Mt. Maquiling, Luzon, this tendency is carried still further. In some of the Philippine specimens the pronotum and the carinae of the frons stand out very light against the dark intercarinal spaces and the shiny dark mesonotum; the abdomen is also dark brown in these specimens.

In spite of this difference in coloration I do not feel justified in giving a specific, or even a subspecific, name to any of these geographical varieties. While the Queensland, Java and Philippine specimens could be grouped together it would be difficult to place the Fiji specimens in either groups, as

they tend towards both. The genitalia are very near to those of *K. kirkaldyi* Muir.

K. fieberi sp. nov. Pl. VI, figs. 49-a.

♂ Length of vertex 1.5 the width; sides of face subparallel except near base where the face is slightly constricted; antennae reaching beyond the apex of the face, first joint slightly longer than half of second; pronotal lateral carinae diverging, straight or slightly convergingly curved at apex where they reach, or nearly reach, the posterior margin of the pronotum; first hind tarsal joint slightly shorter than the other two together, spur as long as first joint, laminate, moderately wide with many fine teeth on hind margin.

Clypeus, genae behind carina, carinae of face, vertex, a broad median band down pro- and mesonotum, lateral portions of pro- and mesonotum, antennae and legs capucine buff or pale yellow-orange; face and genae between carinae, a broad medio-lateral band down pro- and mesonotum, coxae, most of pleura black fuscous or fuscous brown; abdomen brown with the base, a few marks on pleura and hind margins of some of the segments yellow-orange. Tegmina hyaline tinged with capucine buff, veins darker with minute granules bearing black hairs, a fuscous mark near base and another at apex of clavus, a crescent shape fuscous mark over the posterior apical portion of tegmen including the fork of media and 4-7 apical veins, the apical half of the fourth and the fifth and sixth apical cells except on the margin where there is a subtriangular clear mark in each cell, the apical portion of the second and third apical veins also fuscous. Genitalia figured.

Length 1.9 mm.; tegmen 2.9 mm.

♀ Similar to the male but slightly lighter over face and abdomen. Pygophor long and narrow.

Length 2.3 mm.; tegmen 2.9 mm.

Hab. Luzon, P. I., a long series, mostly males, from Los Banos (Muir) and one from Mindanao, Davao (Baker coll.). I also have a specimen from Galle, Ceylon (Bainbrigge Fletcher). There is a slight amount of color variation as to the intensity of the black on face and the extent of infuscation on tegmina. I have honored this little insect with the name of Dr. F. H. Fieber to whom we are indebted for the foundations of the classification of the *Delphacidae*.

Genus BAKERELLA Craw.

B. maculata Craw.

Ten specimens from Mexico Valley (Koebele 1907), one male of which is brachypterous. The tegmina reach the middle

of the fifth abdominal segment, brown over the basal two-thirds of clavus, fuscous or black over the rest, the margins thick, the apical margin and hind margin of clavus white. Length 1.6 mm.; tegmen .7 mm.

Genus DELPHACODES Fieber.

Delphacodes Fieb. subgenus of *Delphax*, logotype *mulsanti* Fieb., Verh. z. b. Ges. Wien XVI (1866), p. 524, Pl. VIII, fig. 32.

Liburnia Stål 1866, Hem. Afr. IV, pp. 176, 179, in part.

Delphax Fabricius Ent. Syst. Suppl. (1798), p. 511, in part (and other authors).

In listing the genera of Delphacidae I retained the name *Liburnia* Stål with *Delphax pellucida* Fabr. as its type* for the largest group of species in the family, thinking that by so doing it would cause the least amount of change. A reconsideration of the matter has convinced me that this name cannot be maintained.

Fabricius described the genus *Delphax* (1798) in which he placed *crassicornis*, *clavicornis* and, at a later date, *pellucida* and other species. There is no such genus as *Delphax* Latr. 1807; in that year Latreille vainly tried to fix *pellucida* Fab. as the type of *Delphax* Fab. Stål and other writers described species under *Delphax* Fab. (not *Delphax* Latr.) which were congeneric with *pellucida* but not with *crassicornis*. In 1866 Stål recognized that *crassicornis* was the type of *Delphax* and so he erected the new genus *Liburnia* to contain those species of *Delphax* which were not congeneric with *crassicornis*. As synonyms of *Liburnia* he gave *Delphax* Auctor and *Embolophora* Stål 1853, and mentioned seven species. It has been contended that the sections *a* and *a.a.* used by Stål to divide his species of *Liburnia* are subgeneric. I cannot agree with this contention as Stål nowhere states this to be the case and he gave no subgeneric names to the divisions. In the same work on pages 15 to 41 he deals with the genus *Tibicen* Latr. and divides it into subgenera which he names and describes.

* Canadian Entomologist, 1915, p. 265.

and in the subgenus *Quintilia* he uses the same method of dividing his species as he does in *Liburnia*, viz., *a*, *a.a*, *b*, *b.b*, etc., a method he used in many other parts of the same work and elsewhere.

The subsequent history of *Liburnia* appears to be that Distant in 1906 selected *monoceros* as the type, and at a later date *monoceros* was separated from the other species as a distinct genus. Thus *Embolophora* and *Liburnia* have the same type and the former takes precedence. My knowledge of the literature from 1866 to 1906 is far from complete so that it is possible that someone separated *monoceros* from the other six species before 1906, in which case *Liburnia* still stands without a selected type, so I name *Delphax vitticollis* Stål.

Stål considered *monoceros* congeneric with *pallens* or he would not have placed them together; what his intentions were I cannot say but he made *Embolophora* and *Liburnia* synonyms. Unless new data is presented I shall consider them as such and use the name *Delphacodes* Fieber 1866 for the group that contains *mul santi* and congeneric species.

D. ordovis (Kirk.).

"*Delphax*" *ordovis* Kirkaldy, 1907, H. S. P. A. Ent. Bull. III, p. 152.

D. parysatis (Kirk.).

"*Delphax*" *parysatis* Kirkaldy, t. c. p. 153.

D. dilpa (Kirk.).

"*Delphax*" *dilpa* Kirkaldy, t. c. p. 162.

D. dryope (Kirk.).

"*Delphax*" *dryope* Kirkaldy, 1907, t. c. p. 154.

D. lazulis (Kirk.).

"*Delphax*" *lazulis* Kirkaldy, 1907, t. c. p. 155.

D. matanitu (Kirk.).

"*Delphax*" *matanitu* Kirkaldy, 1907, l. c.

Also from Papua, Laloki River (Muir, 1909), one macrop-
terous male.

D. hyas (Kirk.).

"*Delphax*" *hyas* Kirkaldy, 1907, t. c. p. 156.

D. disonymos (Kirk.).

"*Delphax*" *disonymos* Kirkaldy, 1907, l. c.

Delphacodes miridianalis sp. nov. Pl. V, fig. 24, 24a.

♂ Vertex as long as wide; head as wide as thorax; antennae reaching slightly beyond base of clypeus, length of first joint to second as 1 to 2.5; medio-frontal carina simple; lateral pronotal carinae divergently curved, not reaching hind margin; brachypterous, tegmen reaching to base of fifth tergite (the pygophor being considered as the ninth abdominal segment); hind tarsus short, first joint slightly longer than the other two together, spur about as long as first joint with many minute teeth on hind margin.

Pygophor a little narrower than deep, margin entire; anal spines strong, near together, slightly curved; genital styles large, flat, broadest at truncate apex, slightly narrowed in middle, the inner apical area bent at a slightly different plane to the basal and outer area; aedeagus slightly flattened laterally, apex rounded, a row of spines from a dorso-apical point down each side to a ventro-subbasal point, a few odd spines over the ventral area.

Head, antennae, thorax and legs ochraceous-buff, frons, genae and clypeus slightly fuscous between carinae; front coxae and a round mark on metapleura dark brown; abdomen blackish brown, lighter over base and pleura; tegmina shiny blackish brown with the extreme base and the margins white or yellowish white, veins concolorous with membrane, without granules.

Length 1.8 mm.; tegmen .7 mm.

♀ There are two females among the series which are uniformly ochraceous-buff.

Length 2.2 mm.; tegmen .9 mm.

Hab. Rotorua, New Zealand (O. H. Swezey, May, 1912). This comes near to *D. dilpa* (Kirk.). from Australia but it can easily be separated by its light head and thorax and by its genitalia.

D. striatella (Fall.)

Mindanao, Davao (Baker coll.). This agrees in every way with specimens from Japan and Europe.

D. terryi sp. nov. Pl. V. fig. 23.

Brachypterous. ♂ Vertex as long as broad; antennae reaching to near the middle of clypeus, second joint double as long as first; frons narrowest at base between eyes, medio-frontal carina simple or furcate only at the extreme base; tegmina reaching to end of abdomen; first joint of hind tarsi as long as the other two together, spur laminate, as long as the first tarsal joint, with many (14-20) fine teeth on posterior edge; lateral pronotal carinae divergently curved, not reaching hind margin.

Face, genae and clypeus between carinae black, carinae of clypeus and face, antennae, vertex, pro- and mesonotum ochraceous, pro- and

mesopleura and coxae black or fuscous, metapleura with a round fuscous spot, abdomen fuscous with the basal segments and posterior edges of 3-8 segments ochraceous. Tegmina ochraceous-buff, fuscous around apex, veins concolorous with membrane, with very minute concolorous granules. Genitalia figured.

Length 1.8 mm.; tegmen 1.3 mm.

♀ Lighter in color, especially between carinae of head.

Length 2.5 mm.; tegmen 1.5 mm.

Macropterous. ♂ Similar in coloration to the brachypterous forms. Tegmina hyaline, slightly opaquely white, veins before cross-veins light yellow, beyond cross-veins brown, apical margin brown, veins with very small granules; wings hyaline, slightly opaque, veins brown. Length of tegmen 3 mm.

♀ Similar in coloration to the brachypterous form, or slightly darker; tegmina similar in coloration and size to that of the macropterous male.

Hab. Java, Dieng Plateau, 7,000 feet elevation. Several specimens bore Dryinid sacs, (F. W. Terry, December, 1908); Formosa, 2 males (Muir, December, 1913).

D. neopropinqua sp. nov. Pl. VI, fig. 38.

♂ Brachypterous. Antennae reaching nearly to the middle of clypeus, first joint half the length of second; first joint of hind tarsus not quite so long as the other two together, spur about as long as the first joint, broad, laminate, with many small teeth on hind margin; lateral pronotal carinae divergently curved, not reaching hind margin.

Ochraceous-tawny, darker between carinae, on face, clypeus and genae fuscous between carinae, coxae and a round spot on metapleura fuscous, abdomen dark, lighter on base, sides, the anal segment and dorsal portion of pygophor. Tegmina ochraceous-tawny, slightly darker over apex, veins concolorous with membrane, without granules.

The genitalia is near to that of *D. propinqua* (Fieb.) but the aedeagus is distinct (Pl. VI, figs. 37, 38); the genital styles have a less angular projection on the inner basal third, and the truncate apices distinctly narrowed.

Length 1.7 mm.; tegmen 1.3 mm.

Hab. Los Banos, Philippine Islands (Baker coll.). This is a Malayan form of *D. propinqua* of Europe.

D. anderida (Kirk.). Pl. VI, fig. 35.

Dicranotropis anderida Kirkaldy, 1907, H. S. P. A. Ent. Bull. III, p. 133.

The frontal carina furcates at the base of frons and I consider that it should be placed in this genus rather than in *Dicranotropis*. It is possibly the same as *Liburnia sordescens* (Motsch.).

Originally described from a series of females from Fiji and Queensland. I have a long series including a few males from Davao, Mindanao, and Mount Maquiling, Luzon (Baker coll.), also a single male from Lappa Island, South China, one from Pekalongan, Java, and one from Peroe, Ceram Island (Muir). I place them all under this species until the male from Fiji and Queensland is known.

♂ Vertex as long as wide; length of face 2.3 times the width, sides nearly straight, slightly narrowed between the eyes, furcation of medio-frontal carina sometimes indistinct; antennae reaching nearly to middle of clypeus, second joint 1.5 times the length of first; lateral carinae of pronotum divergently curved, not reaching hind margin; hind tibiae short, first joint not quite so long as other two together with 2-4 small spines near its base, spur slightly longer than first joint, broad, laminate, with numerous small teeth on hind margin. Genitalia figured; the aedeagus is thin, cylindrical, swollen about the middle where the opening is situated, beyond this it is drawn out to a fine, curved point; anal spines larger, slightly diverging.

Blackish brown, lighter over carinae and on pronotum and legs; abdomen darker with light marks on base and pleura; tegmina hyaline, veins brown, darker on apical half, a dark mark on margin at apex of clavus; some specimens are lighter in color and more of a Sanford's brown.

Length 2 mm.; tegmen 2.8 mm.

The females are ochraceous-tawny, some slightly darker than others.

D. bakeri sp. nov. Pl. VI, fig. 47.

♂ Vertex square; frontal carina furcating at base, sides of face subparallel; antennae reaching to near middle of clypeus, second joint 1.8 times the length of first, slightly thickened especially in middle; lateral pronotal carinae divergently curved, not reaching hind margin; first joint of hind tarsus equal to the two others together, with 2-4 small spines on basal half; spur slightly longer than first tarsal joint, wide, laminate, with numerous small teeth on hind margin.

Head, thorax and legs cinnamon brown, darker over front and middle coxae and a spot on metapleurum; abdomen black or brownish black, lighter over base, pleura and dorsal portion of pygophor and 8th and 7th tergites. Tegmina hyaline, slightly ochraceous, slightly fuscous over cubito-apical cells, veins before cross-veins con-

colorous with membrane, beyond cross-veins brown, a few very small, concolorous granules. Genitalia figured; anal spines strongly curved.

Length 2.5 mm.; tegmen 3 mm.

Hab. Los Banos, Luzon, P. I. (Muir, July, 1916), two male specimens. In build this is very much like *D. anderida* and possesses small spines on the first hind tarsal joint.

D. puella (V. D.).

I have one specimen from Columbus (det. Van Duzee) and others from Dayton and Springfield, Ohio, that agree with the original description and with Crawford's figure of the genitalia. Kirkaldy reported this species from Fiji and Queensland and figured the genitalia of a Queensland specimen*. These figures do not agree with the Ohio specimens and I can find no specimen among the Fiji and Australian material that does. I have placed *D. puella* Kirkaldy not V. D. in *Kelisia* as *K. kirkaldyi*.

D. lacteipennis sp. nov. Pl. VI, figs. 53, 53a.

♂ Head about as broad as pronotum, short; vertex a little broader than long; lateral margins of face arcuate, length of face twice the width, median carina forking at base; antennae reaching a little beyond base of clypeus, second joint 1.8 times the length of first; lateral pronotal carinae divergingly curved; first joint of hind tarsus shorter than other two together, spur as long as first tarsal joint, moderately broad, laminate, with minute teeth on hind margin.

Head and anterior portion of pronotum dark Hessian brown, vertex and carinae at base of face lighter, antennae nearly black, legs brown posterior pair lighter than anterior; posterior portion of pronotum white, creamy white or dirty yellow; meso- and metanotum light brown; abdomen Hessian brown, light on posterior edge of segments and on pleura. On the face, genae and clypeus there are scattered, fine short hairs. Tegmina and wings hyaline, opaquely white, veins yellowish with fine granules on the tegminal veins.

Genitalia figured. Anal spines long, slightly curved, approximate at base, diverging towards apex.

Length 1.4 mm.; tegmen 2 mm.

♀ Brachypterous, tegmina reaching to fourth abdominal segment, orange buff; antennae dark brown, clypeus, face and vertex lighter brown, anterior half of pronotum darker than posterior half. Tegmina hyaline, orange buff; veins concolorous with membrane with concolorous minute granules.

Length 1.6 mm.; tegmen .6 mm.

* H. S. P. A. Ent. Bull. III (1907), Pl. XV, figs. 1-3.

Hab. Described from eight males from Fiji, four males and one female from Java and one male from Formosa (Muir).

D. nigripennis sp. nov. Pl. VI, fig. 55.

♂ Vertex square; face twice as long as broad, slightly narrowed between eyes, sides subparallel; antennae reaching to the middle of clypeus or a little beyond, second joint 1.7 times the length of first; frontal carina forking at extreme base; lateral pronotal carinae slightly divergently curved, not reaching hind margin of pronotum; first tarsal joint about equal to the two others together, spur not quite as long as first joint, moderately wide, with small teeth on hind margin.

Light buckthorn brown or ochraceous buff, fuscous over thoracic pleura, on abdominal sternites and ventral half of pygophor. Tegmina shiny black or dark chocolate, veins concolorous, without granules. Genitalia figured.

Length 2 mm.; tegmen 1 mm.

Hab. Formosa, Daimokko (Muir, January, 1916).

TROPIDUCHINAE.

Ommatissus Fieb.

Dr. Melichar* has questioned the status of *Ommatissus lofouensis* Muir and *O. chinsanensis* Muir from China, partly on account of the geographical distribution; the only other species of the genus being found in Andalusia, Spain. I have not seen specimens of *O. binotatus* Fieb., but the two Chinese species agree with Fieber's figures and descriptions so closely that I cannot change my opinion. In the Chinese species the median vein forks at the cross-veins instead of near the apex; the face is slightly broader; in *O. chinsanensis* Muir the clypeus in profile is slightly more arcuate and in *O. lofouensis* Muir still more so, but these slight differences are not sufficient to create a new genus on. The male genitalia separate the three species.

Neommatissus Muir.

I can find no good characters upon which to separate *Stacotoides* Distant from this genus. I placed this, along with *Ommatissus* Fieb. among the Cixiids as the latter holds that position in Oshanin's Catalogue. They both possess the hair-line dividing off the posterior angle of the mesonotum.

* Mon. Tropiduchinae, Verb. Ver. Brün, 1914.

Reference Tables of the Hawaiian Delphacids and of Their Food-Plants.

COMPILED BY WALTER M. GIFFARD.

The compilation of the following ready reference lists of the known species of Hawaiian Delphacids and of their food-plants was undertaken in the hope that it might in a measure be of some assistance to local collectors of this interesting family. Quite a number of food-plants have been added in these lists to those already known and previously recorded, but much has yet to be learned in this particular direction by continued systematic collecting. I have followed Mr. Frederick Muir's recent Review of the Hawaiian Delphacidae* in listing the genera and species together with the compilations of food-plants recorded therein as well as those published in Fauna Hawaiiensis by my friend, the late Mr. George W. Kirkaldy.† To these has been added information supplied me by Messrs. Timberlake, Swezey, and Bridwell and obtained by them on recent collecting trips in the mountainous region of the Island of Oahu. The author has also included his results of systematic collecting of Delphacids for Mr. Muir on two recent visits to the Kilauea region (4,000 feet elevation) on the Island of Hawaii and on Tantalus (1,500 feet elevation), Oahu.‡ Continued systematic collecting of our endemic Delphacids and other Homoptera will undoubtedly furnish present and future workers in this group with a still better knowledge of the trees and plants on which they feed and this in turn will be of material assistance in the future work of identification.

I am much indebted to my friends, Messrs. Muir, Swezey, and Timberlake, for their generous assistance by means of their collections and field notes.

* Proc. Haw. Ent. Soc., III, No. 3, September, 1916.

† Fauna Hawaiiensis, Vol. II, Part VI (Supplement), pp. 578-598, 1910.

‡ The numbers given in Table I following the author's name as collector are those taken from his field notes which give full details and data as regards environment and the special food plants under observation. The individual specimens in his collections bear corresponding numbers.

Proc. Haw. Ent. Soc. III, No. 4, May, 1917.

The plant names used are according to Hillebrand except in a few cases where a more recent name or combination is used.

TABLE I.

REFERENCE LIST OF HAWAIIAN DELPHIACIDAE WITH THEIR FOOD-PLANTS.*

LEIALOHA

L. naniicola (Kirk.) *Metrosideros polymorpha* Gaud. (1).

L. lehuae (Kirk.) *Metrosideros polymorpha* Gaud. (1).

L. lehuae hawaiiensis Muir *Metrosideros polymorpha* Gaud.

January, 1915, Muir and Giffard; January, 1916, long series with young, Giffard No. 7a. Some nymphs bred to maturity on *Straussia* sp., January, 1917, Giffard and Muir.

L. ohiae (Kirk.) *Metrosideros polymorpha* Gaud. (1).

NESODRYAS

N. freycinetiae Kirk. *Freycinetia arnotti* Gaud. (1); February, 1916, long series with young along with *Nesosydne halia* Kirk., Giffard No. 13a.

N. giffardi Kirk. *Cyrtandra grandiflora* Gaud. (1); *Cyrtandra garnotiana* Gaud. August, 1916, *Rollandia grandifolia* Hbd. March, April, 1916, long series, Timberlake.

N. elaeocarpi Kirk. *Elaeocarpus bifidus* Hook. and Arn. (1); *Cyrtandra paludosa* Gaud. June, 1916, *Scaevolla mollis* Hook. and Arn. June, 1916, long series, Timberlake.

N. eugeniae Kirk. *Syzygium sandwicense* (Gray) (1); March, April, 1916, long series with young Giffard.

N. dodonaeae Muir. *Dodonaea* sp. (2).

N. dryope Kirk. *Antidesma platyphyllum* Mann, January, 1917, Muir and Giffard.

* (1) Refers to Kirkaldy, Fauna Hawaïensis, Vol. II, Part VI, pp. 577-598. (2) Refers to Muir, 1916, Pro. Haw. Ent. Soc., III, No. 3, pp. 168-197. Other numbers refer to writer's field notes.

- N. antidesmae* Muir *Antidesma platyphyllum* Mann, November, 1916, Giffard and Fullaway.
- N. fletus* (Kirk.) *Suttonia* sp., December, 1916, Munro.
- N. gulicki* Muir, *Metrosideros polymorpha* Gand. (2); January, 1917, long series of both sexes, Muir and Giffard; *Osmanthus sandicensis* (Gray), January, 1917; one nymph bred to maturity, Muir and Giffard.
- N. bobae* (Kirk.) *Bobea* sp. (1).
- N. maculata* Muir. *Maba sandwicensis* D. C., long series, *Osmanthus sandwicensis* (Gray), nymphs bred to maturity, January, 1917, Giffard and Muir.
- N. perkinsi* (Kirk.) *Suttonia* sp. (1).
- N. terryi* (Kirk.) *Osmanthus sandwicensis* (Gray), April, 1916, Swezey.
- N. munroi* Muir. *Dodonaea viscosa* L., December, 1916, Munro.

ALOHA

- A. ipomoeae* Kirk. *Ipomoea pes-caprae*, *I. batatas*, *I. bonanox*, *I. tuberculata*, *I. insularis* (1) *Scaevola coriacea* Nutt., August, Swezey.
- A. myoporica* Kirk. *Myoporum sandwicense* Gray (1); *Pelea volcanica* Gray., adults and nymphs, January, 1917, Muir and Giffard.
- A. plectranthi* Muir. *Plectranthus parviflorus* Willd., March, 1915, Swezey; April, Osborn, reared from eggs, no adults taken (2).
- A. kirkaldyi* Muir, *Euphorbia hillebrandi* Forbes, July, 1916, long series, Bridwell, Timberlake.
- A. swezeyi* Muir. *Campylothea macrocarpa* Hbd., February, 1917, series of both sexes, Timberlake; *Lythrum* sp., June, 1916, one male, Swezey.
- A. wailupensis* Muir. *Coprosma longifolia* Gray, June, 1916, one male, Timberlake.

- A. flavocollaris* Muir. *Dubautia laxa* Hook. and Arn., *D. plantaginea* Gaud., July, 1916, long series, Timberlake, Bridwell.
- A. dubautiae* (Kirk.) *Dubautia plantaginea* Gaud. (1); *D. laxa* Hook. and Arn., March, Oct., 1916, Timberlake.
- A. artemisiae* (Kirk.) *Artemisia australis* Less., Kirkaldy, Proc. Haw. Ent. Soc. II, 1910, p. 118.
- A. campylothecae* Muir, *Campylotheca* sp. (2).
- K. kaalensis* Muir, *Campylotheca* sp., July, 1916, long series, Timberlake.

NESORESTIAS

- N. filicicola* Kirk. Ferns (1).
- N. nimbata* (Kirk.) *Phegopteris* sp., April, 1916, Timberlake.

NOTHORESTIAS

- N. badia* Muir, Ferns, one male, Timberlake.

DICTYOPHORODELPHAX

- D. mirabilis* Swezey. *Pittosporum glabrum* Hook. and Arn., March, 1916, two males, Bridwell, Timberlake; *Euphorbia clusiaefolia* Hook. and Arn., June, July, September, 1916, long series, Bridwell, Swezey, Timberlake; *Euphorbia hillebrandi* Forbes, July, 1916, 2 adults and nymphs, Timberlake, Swezey, Bridwell.

NESOSYDNE

- N. koae* Kirk.. *Acacia koa* Gray, on the young leaves, many records of adults and nymphs.
- N. rubescens* Kirk. and var. *pulla* Muir. *Acacia koa* Gray, on the phyllodia, many records of adults and young. Stray specimens of *N. koae* are found on the phyllodia and *N. rubescens* on leaves.
- N. pseudorubescens* Muir. *Acacia koa* Gray (2), January, 1917, Giffard and Muir.

- N. koae-phyllodii* Muir. *Acacia koa* Gray, on the phyllo-dia (2).
- N. pele* Kirk. *Straussia* sp., January, 1917, Giffard and Muir.
- N. oahuensis* Muir. *Charpentiera obovata* Gray, March, April, June, 1916, long series, Timberlake.
- N. cyrtandrae* Muir. *Cyrtandra* sp., September, Swezey.
- N. gouldiae* Kirk. *Gouldia** sp. (1); *Cyrtandra grandiflora* Gaud., August, October, 1916, long series, Timberlake.
- N. blackburni* Muir. *Pipturus alibidus* Gray; January, 1915, Muir and Giffard; October, 1915, and January, 1916, long series with young from isolated trees, Giffard Nos. 5, 10, 11, 14, 17, 5a, 6a, 11a; *Stenogyne calaminthoides* Gray, January, 1916, long series with young, Giffard, Nos. 2a, 4a, 15a; *Clermontia parviflora* var. *pleiantha* Hilleb., January, 1916, small series with young, Giffard No. 14a.
- N. pipturi* Kirk. *Pipturus albidus* Gray (1), February, 1916, long series with young, Giffard, No. 9a.
- N. chambersi* Kirk. *Raillardia* sp. January, 1915, Muir and Giffard; January, 1916, long series with young, Giffard No. 3a, 12a.
- N. cyathodis* Kirk. *Cyathodes tameiameiae* Cham. (1); January, 1915, long series, Muir and Giffard; October, 1915, and January, 1916, very common, Giffard No. 2.
- N. leahi* (Kirk.) *Lipochaeta* sp. Kirkaldy, 1904, Entomologist p. 176; *Lipochaeta calycosa* Gray, June, 1916, long series, Timberlake; *Lipochaeta integrifolia* Gray, November, 1916, long series, Timberlake.
- N. raillardiae* Kirk. *Raillardia* sp. (1); *Raillardia* January, 1916, series with young, Giffard No. 10a; Jan-

* *Gouldia* of Kirkaldy was no doubt a misidentification. The plant in question was undoubtedly *Cyrtandra* sp. [Ed.]

uary, 1917, long series with young and one macropterous female, Muir and Giffard.

- N. ipomoeicola* Kirk. *Ipomoea* sp., *Jussiaea villosa*, *Dolichos lablab* (1); *Ipomoea* sp. February, 1916, long series with young, Giffard Nos. 10a, 18a; *Sadleria* and *Cibotium* ferns; October, 1915, and January, 1916, long series with young, Giffard Nos. 1, 3, 4, 9, 12, 16, 16a; *Lythrum maritimum* H. B. K. January and February, 1916, long series with young, Giffard.
- N. halia* Kirk. *Freycinetia arnotti* Gaud. February, 1916, long series with young, Giffard Nos. 6a, 13a.
- N. giffardi* Muir. *Cyrtandra grandiflora* Gaud. October, 1916, long series, Timberlake.
- N. montis-tantalus* Muir. *Lobelia hypoleuca* Hbd., *Broussaisia arguta* Gaud. March, October, 1916, common on small plants or seedlings close to the ground, Timberlake.
- N. argyroxiphii* Kirk. *Argyroxiphium sandwicense* D. C. (1).
- N. lobeliae* Muir. *Lobelia hypoleuca* Hbd., April-October, 1916, long series, Timberlake.
- N. timberlakei* Muir. *Cyrtandra garnotiana* Gaud. August, 1916, two males and nymphs, Timberlake.
- N. gunnerae* Muir. *Gunnera petaloidea* Gaud., a long series of both sexes and one nymph, mostly along the midrib on the under side of old leaves, July, 1916, Swezey and Timberlake; a male and female off *Pelea* sp., one female off *Coprosma longifolia* Gray and one female off *Suttonia* sp., July, 1916, Timberlake.
- N. asteliae* Muir. *Astelia veratroides* Gaud., July, 1916, a series of males, females and nymphs, Timberlake, Swezey and Bridwell.
- N. fullawayi lanaiensis* Muir. *Cyathodes* sp. December, 1916, Munro.

KELISIA

- K. sporobolicola* Kirk. *Sporobolus virginicus* Kth. (1).
K. swezeyi Kirk. *Eragrostis variabilis* Gaud. October, 1916, Swezey and Timberlake; November, 1916, Giffard and Fullaway.
K. paludum Kirk. *Herpestis monniera* and a sedge (*Juncus* is quoted in error) (1).
K. emoloa Muir. *Eragrostis variabilis* Gaud. June, 1916, Swezey; July, 1916, Timberlake and Bridwell.
Perkinsiella saccharicida Kirk. on sugar-cane and *Peregrinus maidis* (Ashm.) on *Zea mays* are of recent introduction.

TABLE II.

ALPHABETICAL LIST OF KNOWN FOOD-PLANTS AND OF THE DELPHACIDAE ATTACHED THERETO.*

- ACACIA KOA (native name *koa*) *Nesosydne koae* Kirk.; *N. rubescens* (Kirk.); *N. rubescens* var. *pulla* Muir.; *N. koaephyllodii* Muir; *N. pseudorubescens* Muir.
 ANTIDESMA PLATYPHYLLUM (*Hame*) *Nesodryas antidesmae* Muir; *N. dryope* (Kirk.).
 ARGYROXIPHUM SANDWICENSE (*Ahinahina*) *Nesosydne argyroxiphii* Kirk.
 ARTEMISIA AUSTRALIS *Aloha artemisiae* (Kirk.).
 ASTELIA VERATROIDES (*Painiu*) *Nesosydne asteliae* Muir.
 BOBEA sp. (*Ahakea*) *Nesodryas bobeae* (Kirk.).
 BROUSSAISIA ARGUTA (*Kanawau* and *Puahanui*) *Nesosydne montis-tantalus* Muir.
 CAMPYLOTHECA MACROCARPA (*Kokolau*) *Aloha campylothecae* Muir; *A. kaalensis* Muir; *Aloha swezeyi* Muir.
 CHARPENTIERA OBOVATA (*Papala*) *Nesosydne oahuensis* Muir.

* I am indebted to Mr. J. F. Rock for identifications of species of certain of the food-plants given in this list.

- CIBOTIUM (*Hapu*) *Nesosydne ipomoeicola* Kirk.; *Nesorestias filicicola* Kirk.?
- CLERMONTIA PARVIFLORA var. *PLEIANTHA* (*Oha wai*) *Nesosydne blackburni* Muir.
- COPROSMA LONGIFOLIA (*Pilo, Olena, Koi*) *Aloha wailupensis* Muir.
- CYATHODES TAMEIAMEIA (*Pukeawe, Maieli*) *Nesosydne cyathodis* Kirk.; *N. fulawayi lanaiensis* Muir.
- CYRTANDRA sp. *Nesosydne cyrtandrae* Muir.
- CYRTANDRA GARNOTIANA *Nesodryas giffardi* Kirk.; *Nesosydne timberlakei* Muir.
- CYRTANDRA GRANDIFLORA *Nesosydne giffardi* Muir; *N. gouldiae* Kirk.; *Nesodryas giffardi* Kirk.
- CYRTANDRA PALUDOSA *Nesodryas elaeocarpi* Kirk.
- DODONAEA sp. (*Aalii, Aalii kumakua*) *Nesodryas dodonaeae* Muir.
- D. VISCOSA *N. munroi* Muir.
- DOLICHOS LABLAB *Nesosydne ipomoeicola* Kirk.
- DUBAUTIA LAXA (*Naenae*) *Aloha flavocollaris* Muir; *Aloha dubautiae* (Kirk.).
- DUBAUTIA PLANTAGINEA (*Naenae*) *Aloha dubautiae* (Kirk.), *Aloha flavocollaris* Muir.
- ELAEOCARPUS BIFIDUS (*Kalia*) *Nesodryas elaeocarpi* Kirk.
- ERAGROSTIS VARIABILIS (*Emoloo*) *Kelisia emoloo* Muir; *Kelisia swezeyi* Kirk.
- EUGENIA SANDWICENSIS (*Ohia-ha, Paihi*) *Nesodryas eugeniae* Kirk.
- EUPHORBIA CLUSIAEFOLIA (*Koko, Akoko*) *Dictyophorodelphae mirabilis* Swezey.
- EUPHORBIA HILLEBRANDI (*Koko Akoko*) *Aloha hirkaldyi* Muir; *Dictyophorodelphae mirabilis* Swezey.

- FREYCNINETIA ARNOTTI (*Ie-ie*) *Nesodryas freycinetiae* Kirk.;
Nesosydne halia Kirk.
- GOULDIA sp.* (*Manono*) *Nesosydne gouldiae* Kirk.
- GUNNERA PETALOIDEA (*Apé*) *Nesosydne gunnerae* Muir.
- HERPESTIS MONNIERIA *Kelisia paludum* Kirk.
- IPOMOEA sps. *Nesosydne ipomoeicola* Kirk.; *Aloha ipomoeae*
 Kirk.
- JUSSIAEA VILLOSA (*Kamaole*) *Nesosydne ipomoeicola* Kirk.
- LIPOCHAETA CALYCOSA (*Nehe*) *Nesosydne leahi* (Kirk.).
- LIPOCHAETA INTEGRIFOLIA (*Nehe*) *Nesosydne leahi* (Kirk.).
- LOBELLA HYPOLEUCA *Nesosydne montis-tantalus* Muir; *N. lobelliae* Muir.
- LYTHRUM MARITIMUM (*Ninika*) *Nesosydne ipomoeicola* Kirk.
- MABA SANDWICENSIS (*Lama*) *Nesodryas maculata* Muir.
- METROSIDEROS POLYMORPHA vars. (*Ohia lehua*) *Leialoha nanii-*
cola (Kirk.); *L. lehuae* (Kirk.); *L. lehuae hawaiiensis*
 Muir; *L. ohiae* (Kirk.); *Nesodryas gulicki* Muir.
- MYOPORUM SANDWICENSE (*Naio*) *Aloha myoporicola* Kirk.
- OSMANTHUS SANDWICENSIS (*Pua* or *Ulupua*) *Nesodryas gu-*
licki Muir, *N. terryi* (Kirk.); *N. maculata* Muir.
- PELEA VOLCANICA (*Alani*) *Aloha myopoicola* Kirk.
- PHIEGPTERIS sp. *Nesorestias nimbata* (Kirk.).
- PIPTURUS ALBIDUS (*Mamake*) *Nesosydne blackburni* Muir;
N. pipturi Kirk.
- PITTOSPORUM GLABRUM (*Hoawa*) *Dictyophorodelphax mira-*
bilis Swezey.
- PLECTRANTHUS PARVIFLORUS *Aloha plectranthi* Muir.

* See footnote, page 343.

- RAILLARDIA sp. (*Kupana*, *Naenae*) *Nesosydne chambersi* Kirk; *N. raillardiae* Kirk.; *N. osborni* Muir.
- ROLLANDIA GRANDIFOLIA *Nesodryas giffardi* Kirk.
- SADLERIA sp. (*Amamau*) *Nesosydne ipomoeicola* Kirk.; *Nesorestias filicicola* Kirk.
- SCAEVOLA CORIACEA (*Naupaka*, *Naupaka kuahiwi*, *Ohenau-paka*) *Aloha ipomoeae* Kirk.
- SCAEVOLA MOLLIS *Nesodryas elaeocarpi* Kirk.
- SPOROBOLUS VIRGINICUS *Kelisia sporobolicola* Kirk.
- STENOGYNE CALAMINTHOIDES *Nesosydne blackburni* Muir.
- STRAUSSIA sp. (*Kopiko*) *Nesosydne pele* Kirk. *Leialoha lehuae hawaiiensis* Muir.
- SUTTONIA sp. (*Kolea*) *Nesodryas fletus* (Kirk.) *Nesodryas perkinsi* (Kirk.).
- SYZYGIUM SANDWICENSIS (*Ohia-ha*, *Paihi*) *Nesodryas eugeniae* Kirk.
- TOUCHARDIA LATIFOLIA (*Olona'*) *Nesodryas giffardi* Kirk.

TABLE III.

LIST OF SPECIES OF HAWAIIAN DELPHACIDAE FOR WHICH THE
FOOD-PLANTS ARE AT PRESENT UNKNOWN
OR IN DOUBT.

- Leialoha oceanides* (Kirk.); *N. pacifica* (Kirk.)
- Nesodryas fletus* (Kirk.); *N. frigidula* (Kirk.); *N. hula* (Kirk.); *N. laka* (Kirk.); *N. pilani* (Kirk.); *N. pluvialis* (Kirk.); *N. silvestris* (Kirk.).
- Nothorestias badia* Muir.
- Nesosydne swezeyi* Muir; *N. anceps* Muir; *N. nephrolepidis* Kirk.; *N. perkinsi* Muir; *N. wailupensis* Muir; *N. fullawayi* Muir; *N. incommoda* Muir; *N. sharpi* Muir; *N. rocki* Muir; *N. monticola* Kirk.; *N. haleakala* Kirk.; *N. nephelias* Kirk.; *N. procellaris* Kirk.; *N. umbratica* Kirk.; *N. hamadryas* Kirk.; *N. palustris* Kirk.; *N. nubigena* Kirk.; *N. imbricola* Kirk.

ANNUAL ADDRESS.

Economic Aspects of Our Predaceous Ant*(Pheidole megacephala)*

BY J. F. ILLINGWORTH.

Even the most casual observer is interested in ants. Their extraordinary instincts appeal to the imagination; hence, we find allusions to their industry and perseverance in the earliest literature. 1000 B. C., Solomon pointed to the ants for the emulation of society, and correctly observed that each individual was able, instinctively, to fulfill the demands of social life without "chief, overseer, or ruler".

Their great value in the economy of nature demands our consideration. They not only remove myriads of dead insects, but, also, act as an important factor in the destruction of the living. Forel estimated that a large colony would bring in 100,000 daily during their greatest activity. Moreover, in some countries predaceous ants are regarded as useful allies in the control of insect pests, and we might profitably consider McCook's (1882)* suggestion, that foreign ants be introduced for such purposes.

Though ants often come into conflict with our activities, and there is a popular notion that they are noxious insects, I believe, with Forel and other leading students of the subject, that a consideration of all the facts forces us to the conclusion that as a group they are eminently beneficial.

Ants have become dominant insects through their splendid adaptability and terrestrial habits, as has been pointed out by several authors. Their varied diet, simple home-life, and freedom from enemies being important factors leading to their success. "The worst enemies of ants are other ants, just as the worst enemies of men are other men." Hence, it is a rather common experience, in the tropics, to find that one species becomes dominant in a certain region, at the expense of all the other ant-fauna.

* Dates in parenthesis refer to bibliography.

Proc. Haw. Ent. Soc. III, No. 4, May, 1917.

A notable case (Wheeler, 1906) is the supplanting of *Pheidole megacephala*, by the Argentine ant (*Iridomyrmex humilis*), in Madeira. This displaced species which has proved itself so dominant in other warm countries of the world, evidently met a superior foe in the pugnacious South American ant. This superiority appears to be evidenced by the way that the Argentine ant is displacing all other ants in our Southern States. Dr. Wheeler (1910), further, gives interesting accounts of the dominance of *P. megacephala* in tropical countries, citing particularly, Bermuda and the Virgin Islands. He then predicted that this species would rapidly exterminate the ant-fauna of tropical or subtropical regions, wherever it was able to gain a foothold, and propagate abundantly. This prediction is certainly proving true in the case of Hawaii, at least as far as out-of-door nesting species are concerned.

One has but to observe in some particular region of our Islands, for a few years, to note the supplanting of other ants by *P. megacephala*. At my home, in Palolo Valley, this latter species is now the dominant ant, out-of-doors. As recently as 1913, the black ant (*Prenolepis longicornis*) was there in myriads, and the yard contained several nests of the fire ant (*Solenopsis geminata* var. *rufa*); both these species have now entirely disappeared. The first was particularly troublesome from the fact that whole colonies frequently moved into the house, locating the brood about the water pipes, or inside the tank of the toilet. They gave further trouble by being omnivorous feeders; so we were glad to see them replaced, even though it might be a case of "out of the frying pan into the fire". The *megacephala*, however, have at least kept their family affairs out-of-doors.

Dr. Perkins (1913) has described in a most convincing manner the effects of this dominant introduced ant upon our endemic insect-fauna. For he considered that it had practically exterminated the native insects, particularly the beetles, within its range. But, as he remarked, foreign or imported insects often flourish in spite of it.

Dr. Wheeler has recently written me of his observations on *P. megacephala* in Queensland, Australia, where, he says,

one can see very easily the supplanting of the native ants by this species.

ORIGIN.

Considering that the habits of this species were first studied extensively by Professor Heer (1852, 1856) in Madeira, and the name *Ecophthora pusilla*, given to it by him, it is only natural for Brown (1869) to consider this ant peculiar to that island.

Investigations of recent years have demonstrated that *P. megacephala* is cosmopolitan, at least in the tropics and subtropics. Dr. Wheeler informs me that the species seems to have come from Madagascar or Africa originally, for it belongs to a group of *Pheidole* which is best represented in those regions.

There is no record of the time when this ant was introduced into Hawaii, but Dr. Perkins (1913) states that even during the last twenty years it has occupied some considerable areas previously free from it. Blackburn and Kirby (1880) recorded it under the name *Pheidole pusilla* Heer, remarking that it was "one of the commonest ants in Oahu, and probably elsewhere."

DISTRIBUTION.

It is an extremely easy matter for ants to be distributed by shipping, for it is a common experience to find them in packages of merchandise upon the wharves. A good illustration of this fact was recorded by Eckart (1902), who received a barrel of borer-infested seed-cane from Demerara, which upon opening up was found to be swarming with *P. megacephala*.

The range of these ants is largely controlled by climatic conditions. They are not tolerant of cold weather, and apparently, extremes of humidity are very injurious to them.

Girault (1915) has recorded the destruction of vast numbers, due to slight frost in Queensland; but his last statement that the heaps of dead all seemed to be in ruts, might imply that water came in as an additional death-factor. On several occasions, while in Fiji during 1913, I observed similar piles

of dead *megacephala*, which had been carried out of the nests by the survivors. These fatalities apparently always took place during cool rainy nights, and the heaps of dead were only found at the entrances of nests located in the furrows between the cane rows. The indication is that the ants were overtaken by a flood of water, while in a chilled condition, otherwise we should expect dead in the nests on the ridges as well as in the furrows. An experiment was tried of flooding a nest for a brief period during the day, but apparently no fatalities resulted, for as soon as the water subsided the workers began carrying the brood to a drier location.

Dr. Perkins (1913) mentions low-lying localities, along the coast, which from excessive dryness and other causes, the *Pheidole* is unable to occupy, at any rate permanently. A good example of such a locality is to be found just beyond Koko Head crater, here on Oahu. Going over into this valley, a marked change in the insect-fauna is to be noted. While *megacephala* is the dominant ant on the Honolulu-side of the crater, there is scarcely a trace of this species on the opposite side, which is an extremely dry and windswept area. Several other ants have, however, adapted themselves to these difficult conditions. Both *Prenolepis longicornis* and the fire ant (*Solenopsis geminata* var. *rufa*) are there in abundance. The first species favoring the region of coral sand, and the second the alluvial soil, further back from the shore, in accordance with its agricultural habits.

It is interesting to recall that these are the same species, recently exterminated by *megacephala* in the vicinity of my home, in Palolo Valley. They are certainly driven to the "ends of the earth" in a region such as we find beyond Koko Head.

HABITS.

In favorable regions, such as we find in any of our humid valleys, *P. megacephala* is exceedingly abundant. These ants make use of every stone for a roof, and the large cracks in the volcanic soil, which form during the dry season, furnish them ready-made chambers to a considerable depth. Naturally, heavy rains are unfavorable to them in this spongy soil, and

they probably suffer severe loss. Under such circumstances, we find them bringing great piles of the brood to the surface, and depositing it just beneath the stones or other objects, where it may be easily destroyed by further floods.

When thus set-to to save their brood, the ants make use of any structure above ground; hence, we find them doing considerable damage in unprotected apiaries* during the rainy season. At this time every hive has a thriving colony of ants beneath it, and, as the soil becomes saturated, they try to move inside. They build covered runways, of soil and bits of trash, connecting their nest with the opening to the hive, and thus effect an entrance without apparent remonstrance on the part of the bees. The ants then begin their attack by catching the bees along the edges of the combs, but with each success their numbers increase, until they literally cover every square inch of space within the hive, and the remaining bees are compelled to flee for safety. When the swarm has been thus gotten rid of, the ants devote their attention to the destruction of the larval bees, and often move part of their nest into the hive.

In such an onslaught it is the small workers who rush in from all sides, seizing legs and wings of the prey; but they are soon assisted by the soldiers, who not only help to hold the struggling insect, but also offer most effective service in dismembering it with their powerful jaws, and, in biting it up into pieces of such size that they can be easily carried by the workers. The soldiers apparently disdain any other duties than these, for they have not been observed either carrying food, or assisting in the removal of brood in the suddenly opened nest. In the regular file of workers, struggling under their heavy loads, these big-headed fellows march along empty handed. They have an inquisitive way of rushing up to each worker that they meet and touching antennae for an instant before passing. Furthermore, the workers do all the foraging—a great excess of soldiers being usually found in the nest, as if waiting for a “call to arms”. As soon as a new food

* Methods for the protection of bees discussed under control measures.

supply is located, however, the soldiers advance in a constant stream, along with the workers.

Mr. E. C. Smith, manager of the Garden Island Honey Company, of Honolulu, tells me that with their 5,000 colonies, located on the various islands, they experience by far the greatest difficulty from these ants on the Island of Hawaii; for most of their apiaries are there located in very humid districts. He says that, even here on Oahu, at least twenty-five per cent of the colonies are destroyed during each rainy season, unless protected. It is his experience that no colony, no matter how strong, can withstand these predators, for more than a few days, if once set-upon.

It is fortunate for the apiarist that the ants are omnivorous in their diet, and that they feed upon bees during so short a season; for even though a successful method of keeping them out of the hives has been devised, the expense for the labor item of carrying on the combat throughout the year would be prohibitive.

Since these ants show a decided preference for an insect diet, their activities may lead them to attack other introduced beneficial insects. Fortunately, many of these, for example the hymenopterous parasites, appear to be more or less immune but, as I have recorded (1914) the breeding of dipterous parasites, in Fiji, was greatly hampered by *megacephala*.

Apparently this is a further case of the effects of climate upon the activities of this ant. Fiji, being nearer the equator, is warmer than Hawaii, and *megacephala* is much more abundant, at least, in the cane districts. As far as we were able to observe, none of the thousands of flies that we liberated during the first nine months were able to establish themselves. This was probably due to the fact that the work was started at the beginning of the dry season, at a time when the ants were exceedingly abundant. The breeding cages were moved, however, to a new district, during the following wet season, and in scarcely three months after the liberation (February, 1914) of 320 flies, they were found breeding in the field, and three months later, at cutting time, they were found to be so well established that the fly puparia could be found in almost

every borer-infested stalk, and they had spread over several fields. By the end of the dry season, however, the ants, which had become scarce during the wet weather, were again exceedingly abundant, and no flies or their puparia were to be found.

We have had similar experience in each of the districts where the flies have been liberated, even to those that were sent over to Queensland,—at first they would appear to be established and spreading in the fields during the rainy season, but later they would entirely disappear.

The only way that I can account for the way these flies have succeeded in Hawaii is that *megacephala* is not nearly as numerous here.

Though these ants are often regarded as noxious insects because of their relation to Aphids, Coccids and leaf-hoppers, we must give them credit for the fact that they often devour these insects, especially if there is a shortage of the honey-dew. Professor Heer (1852 and 1856) speaks with surprise of their destruction of cochineal insects, and recently Swezey (1913) recorded their eating some of the mealy bugs on sugar cane. Moreover, Dr. Wheeler (1910) points out that ants also render some assistance by removing the sweet excretions produced by these various bugs, for if left to fall upon the leaves, it forms a culture for destructive leaf fungi.

Furthermore, this species can hardly be regarded as a household pest. Though they show a fondness for foods containing fats and proteids, particularly meats, beans, cheese, butter, etc., these foods can easily be protected from them. I have not observed that they show a particular liking for sweets, in the house, as recorded by Professor Heer (1852, 1856). As he noted, however, they do have a decided preference for an insect diet, and we find them not only removing the dead insects that chance about the place, but also going after the living. One remarkable case was that of some dried fish which had become thoroughly infested with Dermestid larvae. When first observed, the ants were all over this fish and vigorously attacking the spiny larvae. Within two days not one of the

pests remained and the ants gradually dispersed without in any way molesting the fish.

During dry weather the ants often come into the house after water, and I have found them swarming over the inverted drinking-glass. On one occasion, when taking a drink in the dark, I felt a gritty substance in my mouth from the edge of the glass, and upon investigation in the light I found that I had devoured a few dozen ants. Fortunately, they have no taste, so, if we did not know that they were present, we might eat them with impunity.

It is in their relation to our pests out-of-doors that ants of this species have demonstrated their great usefulness. As early as 1852, Professor Heer observed that they held an important economic position, for they attacked many of the most destructive pests, and no insect appeared to be too large for them. Even in their activities against house-flies, which I have recorded (1913), they render a most valuable service. For the breeding possibilities of this pest, if uncontrolled, in tropical countries, would be inestimable.

As pointed out by Dr. Perkins (1913) there are very few of the native insects that can long resist this predator; and the same might be said for some of our introduced species. Even insects as big and powerful as our mole cricket (*Gryllotalpa africana*) are destroyed. I have several times observed these crickets in the clutches of the ants, on sandy soil, and they appeared to be powerless to throw off their little tormentors. In one instance I counted sixteen ants on one leg, and there appeared to be as many on each of the other appendages, including the cerci. In their struggle to hold the prey, the ants seized upon every bit of rubbish that came in their way, so that the cricket was soon weighted down and tired out, carrying this load. He made many attempts to get into the soil but the mass of ants kept their hold upon him until the soldiers succeeded in puncturing the wall of his abdomen, after which the struggle was brief. Cardin (1913) has reported that the ants are the most dreaded enemies of a mole cricket, in Cuba, and he partly attributes the scarcity of this pest, in that country to them.

To form some conclusion as to how such minute insects are able to dominate creatures even hundreds of times their size one has but to observe their persistence and the tenacity of their attack. In Fiji I could hardly collect any insects, at lights, which did not have a number of these ants attached to them. Even the powerful June beetles, (*Rhopoea* sp.) which destroy large areas of sugar-cane by feeding upon the roots, were attacked—often as many as two dozen ants clinging to the legs when captured. Of course, it is impossible to tell how long these ants had maintained their grip upon the insects, but possibly for hours, since they apparently never give up, as long as there is any hope of success.

On one occasion I discovered two soldiers and a few workers holding a large Dermestid larva, and though I watched them for over two hours they hardly changed their positions. The only motions that I could observe were that the ants continually braced themselves, shifting the feet, and there was a periodic jerking of the abdomen, especially by the soldiers.

CONTROL MEASURES.

Let me emphasize in the beginning, that with these ants, our objects should be control and not destruction. If these little creatures, through their zeal, come into conflict with some of our interests, we should not at once try to kill them, but, rather, to devise a means to keep them out of trouble. Therefore, of the numerous remedies that have been recommended for ants, I will not here consider those which aim at their destruction.

The method devised by Mr. E. C. Smith for the protection of bees is, like many important discoveries, both simple and effective. The corners of the hive are supported on the heads of sixty-penny spikes, coated with axle grease (Plate VII). Any kind of a frame-work may serve for the attachment of the spikes, but Mr. Smith has finally standardized it; using two pieces of 2 x 3, which measure just the width of the hive, and a 1 x 3, as long as the hive, for a spreader. In getting out this material at the mill, holes are bored into the 2 x 3s, so that the nails will all enter the same distance, and give no trouble from splitting.

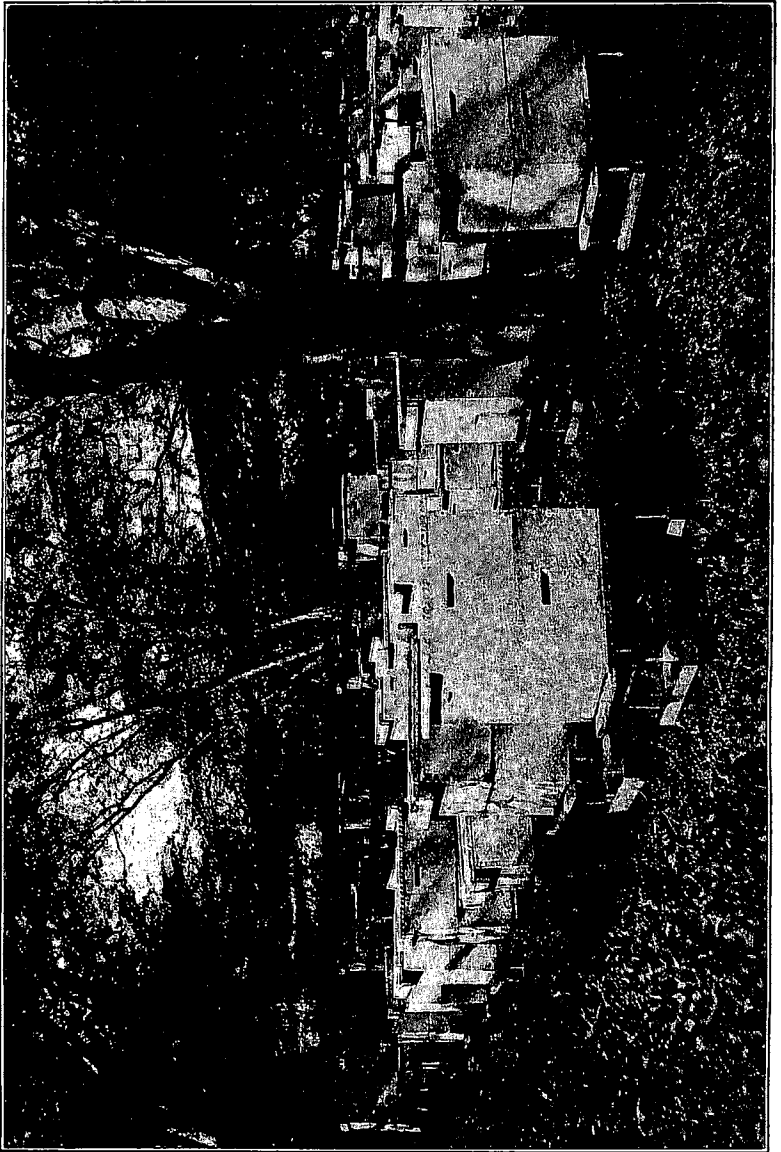


PLATE VII.

Corner of College of Hawaii apiary, showing special stands to keep out ants.

Many difficulties were experienced in trying to keep ants away from the bees, before their aversion for axle grease was discovered. About ten years ago hives in some places were supported upon posts for the easy application of ant-poison, while other apiaries were protected by tins of water, as illustrated by Dr. Phillips.* Both methods had to be discarded, because of the necessity of frequent renewals, which made the cost prohibitive. Tanglefoot, also, proved worthless, from the fact that the ants would bridge over it, in one night, with bits of rubbish. Axle grease, on the other hand, appears to be very distasteful to them, and they stay away from it. This substance also has the advantage of being rather permanent, lasting for two or more months. Hence, a couple of applications are all that are required to carry the bees safely through the wet-season; and the balance of the year they require no protection.

For barriers, indoors, axle grease is hardly suitable, but the well-known bi-chloride-of-mercury band is equally effective, if kept dry. Narrow lamp-wicks serve best for this purpose. They are soaked in a saturated solution of the poison, and hung up to dry, before pinning about the legs of the furniture, etc.

What appears to be a most effective remedy has recently been used** by Mr. Arthur Gibson, of the Department of Agriculture, at Ottawa, Canada, but I have not had time to try it upon our ants. It consists in simply dusting sodium fluoride in the places frequented by the ants, and they soon disappear. This chemical has been recommended† for the destruction of cockroaches, but Mr. Gibson's article would indicate that the ants are simply driven away by it.

ANNOTATED BIBLIOGRAPHY.

‡ 1852. Heer, O.—Ueber die Hausameise *Madeiras*. An die Zürcherische Jugend auf das Jahr 1852, von der Naturforschenden Gesellschaft, 54 Stück, 1-24.

* U. S. Dept. Agric. Bur. Ent. Bul. 75, Pls. VII and X.

** Can. Ent. XLVIII, 365-367.

† U. S. Dept. Agric. Farmers' Bul., 658.

‡ I have not seen this paper.

Professor Heer's original account of the habits of our species, for which he used the name *Æcophthora pusilla* Heer. For complete translation, see the next paper.

1856. Heer, O.—On the house ant of Madeira. Translated from the original by Lowe, R. T. Ann. and Mag. Nat. Hist. 2d ser. XVII, 209-224 and 322-333, 1 Pl.

The author states that these ants were found on the whole south side of the Island of Madeira, up to a height of 1,000 feet, in countless numbers, especially in hot, sunny places. They were under practically every stone, and there was hardly a house that did not harbor millions of them.

They were said to show little preference as to kinds of food attacked in houses; going after sweets (sugar, honey, syrup, preserved fruits); but not less also fresh fleshy fruits of all kinds. They seemed to prefer flesh to vegetable substances. Raw and boiled meat was eagerly sought by them; but insects were very decidedly preferred. Great trouble was experienced in guarding the collections of insects from them. The author remarks that they did not, however, seek after dead insects only, but attacked also the living. He notes their attack upon flies, termites, grasshoppers and even the destruction of the cochineal insects, and, members of their own family. In these attacks upon large living-insects, it was noted that the soldiers were never the ones to make the original assault, but only entered in after the first seizure by workers. The soldiers, however, rendered efficient aid in cutting off wings and legs of the larger insects, and in breaking them up into bits which were easily carried by the workers.

1869. Brown, F. H.—Some observations on the fauna of Madeira. Proc. Bost. Soc. Nat. Hist. XII, 211.

"A very troublesome little ant, abounds in the houses of Madeira, and is supposed to be peculiar to the island. It has received the name *Æcophthora pusilla* from Prof. Heer, who has written an account of this little animal."

1880. Blackburn, T., and Kirby, W. F.—Notes on species of aculeate Hymenoptera occurring in the Hawaiian Islands. Ent. Mo. Mag. XVII, 89.

The species is recorded under the name, *Pheidole pusilla* Heer, with the remarks:

"One of the commonest ants in Oahu, and probably elsewhere. (T. B.)"

"The house-ant of Madeira; and occasionally met with in England. (W. F. K.)"

1882. McCook, H. C.—Ants as beneficial insecticides. Proc. Acad. Nat. Sc. Philad. 1882, 263-271.

This article is a discussion of the practicability of the use of ants for the destruction of insect pests, as practiced in the province of Canton, China.

The Chinese are said to protect their orange trees from dreaded pests by importing ants from neighboring hills. The growers themselves supply some ants, which prey upon the enemies of the orange, but not in sufficient numbers; and resort is had to hill-people, who, throughout the summer and winter find the nests suspended from branches of bamboo and various trees. There are two varieties of ants, red and yellow, whose nests resemble cotton-bags. The collectors are supplied with pig or goat bladders, which are baited inside with lard. The orifices of these they apply to the entrance of nests, when the ants enter the bags and become a marketable commodity at the orchards. Orange trees are colonized by depositing the ants on their upper branches, and to enable them to pass from tree to tree all the trees of an orchard are connected by bamboo rods.

The author discusses the subject under several heads, and sums up:

Even if the ant should not be as tractable for domestication as her hymenopterous ally, the bee, and in spite of her occasional forays upon our cupboards and crops, the ant is worthy to stand at the head of insects beneficial to man.

1899. Forel, A.—*Pheidole megacephala* Fab. Fauna Hawaiiensis I, 118.

"Hab. All the Islands from the coast to an elevation of 3,000 feet. Cosmopolitan."

1902. Eckart, C. F.—Report on precautions to be observed with regard to cane importations. Haw. Sugar Planters' Assn., p. 8.

A barrel of seed-cane imported from Demerara was found to be badly infested with borers, and the empty channels of the beetles were alive with our common ant (*Pheidole megacephala*). Upon opening the sticks, traces were found of both larvae and pupae of the borers, which had been destroyed by the ants, but only a single beetle was found, alive, in the consignment, having escaped because of its perfect cocoon, which is difficult for the ants to enter.

1903. Perkins, R. C. L.—The leaf-hopper of sugar cane. Bd. Comm. Agric. and Forestry, Bul. 1, 23.

Pheidole megacephala was noted, as one of the species of ants preying upon the young leaf-hoppers.

1905. Perkins, R. C. L.—Entomological and other notes on a trip to Australia. Proc. Haw. Ent. Soc. I, 9.

At Cairns *Pheidole megacephala* swarmed everywhere, and no lady-bird or its larva could get at the scales on many badly affected trees.

1906. Wheeler, W. M.—On certain tropical ants introduced into the United States. Ent. News, XVII, 24.

Notes, the supplanting of *Pheidole megacephala* by the Argentine ant (*Iridomyrmex humilis* Mayr), in Madeira. The author quotes from Prof. Heer's description of the former species.

1909. Swezey, O. H.—Notes on the budmoth of sugar cane, etc. Haw. Planters' Record, I, 133.

The author states that *P. megacephala* is always abundant in cane, often having its nests beneath the leaf sheaths. It destroys not only the young bud worms but also other cane-feeding caterpillars.

1910. Wheeler, W. M.—Ants, p. 154-155.

The author quotes, from Professor Heer's account of *P. megacephala*, and states that this ant is very common in Bermuda and West Indies and will probably be found in Florida. He says that there can be little doubt that wherever it gains a

foothold in tropical or subtropical countries it is able to propagate very rapidly and to exterminate the indigenous ant-fauna. Bermuda and the Virgin Islands are cited as cases in point; and the following interesting observations are recorded:

"During March, 1906, I devoted ten days to a careful study of the ant-fauna of the little Island of Culebra, off the eastern coast of Porto Rico, without seeing a single specimen of *Ph. megacephala*. This island is, however, completely overrun with a dark variety of the vicious fire-ant (*Solenopsis geminata*). One day, on visiting the Island of Culebrita, which is separated by a shallow channel hardly a mile in width from the eastern coast of Culebra, I was astonished to find it completely overrun with *Ph. megacephala*. This ant was nesting under every stone and log, from the shifting sand of the sea-beach to the walls of the light-house on the highest point of the island. The most careful search failed to reveal the presence of any other species, though the flora and physical conditions are the same as those of Culebra. It is highly probable that *Ph. megacephala*, perhaps accidentally introduced from St. Thomas, a few miles to the east, had exterminated all the other ants which must previously have inhabited Culebrita. The absence of *megacephala* on Culebra is perhaps to be explained by the presence of the equally prolific and pugnacious fire-ant."

1913. Cardin, Patricio.—A probable parasite of *Scapteriscus didactylus* in Cuba. Journ. Econ. Ent. VI, 330-331.

The author states that the fire ant (*Solenopsis geminata* Fab.), and the common red ant (*Pheidole megacephala* Fab.), were the most dreaded enemies of the mole cricket, or "changa", in high and dry land, and he partly attributes the scarcity of this pest, in Cuba, to the attacks of these pests.

1913. Illingworth, J. F.—Little brown ant doing good work in Hawaii. Haw. Forester and Agric. X, 370-371.

The writer states that *P. megacephala* appears to be the principal factor holding house flies in check under tropical conditions. It is estimated that the ants destroy fully 75% of the flies; carrying off most of the eggs or larvae as soon

as they find them. Furthermore, they were observed attacking and dismembering adult flies.

1913. Swezey, O. H.—Sugar cane mealy bugs in the Hawaiian Islands. Haw. Planters' Record. VIII, 208.

The author states that *P. megacephala* is always present and although feeding largely on the sweetish excretions, yet does eat some of the mealy bugs.

1913. Perkins, R. C. L.—Introduction, Fauna Hawaiianis, I, xli and ci.

From the standpoint of the systematist, the author gives this most interesting survey of *P. megacephala* in Hawaii:

"As with the birds, destruction of forest has, doubtless, caused the disappearance of many local insects, but even of greater importance has been the introduction of foreign carnivorous species, especially of the dominant ant, *Pheidole megacephala*. There is no record of the time when this destructive creature was imported, but even during the last twenty years it has occupied some considerable areas previously free from it. It may be said that no native Hawaiian Coleopterous insect can resist this predator, and it is practically useless to attempt to collect where it is well established. Just on the limits of its range one may occasionally meet with a few active beetles, e. g. species of *Plagithmysus*, often with these ants attached to their legs or bodies, but sooner or later they are quite exterminated from such localities. It is quite certain that native beetles and many other insects are absent from the localities occupied by *Pheidole*, solely on account of its presence. In several instances, as the ant has been observed to occupy a new area, this area having been collected over before it was present and yielding many native beetles, the latter have entirely disappeared. In a few low-lying localities, even close to the coast, there are some places, which from excessive dryness and other causes, the *Pheidole* is unable to occupy, at any rate permanently, and yet unfavorable, as these are, for insects of any kind, here only will native Coleoptera be found. On one occasion I came across an instructive instance of the effect of these ants on the native fauna. A more or less open piece of forest at an elevation of 1,500 feet above sea level, with a

large variety of trees scattered in it, appeared at first sight an excellent spot for collecting native insects. A number of native Hymenoptera were seen flying round the foliage, hardy insects which the ants cannot exterminate, though they are often seen attached to them by the mandibles. Every tree trunk was invaded by *Pheidole*, and beating the boughs dislodged them in thousands. Not a single beetle nor any native insect was obtained from these trees. One solitary tree, however, for some reason was quite free from ants. It was a large *Bobea*, with hanging masses of 'Maile' (*Alyxia*) dependent from the boughs. From the dead stems of this were shaken hundreds, if not thousands, of one species of *Proterhinus*, others also being present, as well as the large weevils, *Rhyncogonus*, and other kinds of beetles. I visited this spot on many occasions for the sake of a rare species of wasp, but never obtained a beetle except from this one tree, and a year later it too was occupied by *Pheidole* and barren of native insects. Fortunaetly *Pheidole* is not universal in its distribution. It can in some localities just attain 4,000 feet in the mountains, under certain climatic conditions. Below twelve or thirteen hundred feet it often occupies most of the islands, excepting some extremely arid localities. Though not so utterly destructive to other insects as to the beetles, yet many of them are destroyed by it, and generally speaking, collecting is very poor, where it abounds. Most of the native species taken in such places are vagrant, like Lepidoptera, and have bred in some adjoining area, either free from this ant, or where it is comparatively sparse. Miles of attractive forest in some parts of the islands are almost devoid of native insects, through its destructiveness. A very few endemic insects seem able to breed in its haunts, even where it is quite abundant, but many of the foreign or imported insects flourish in spite of it. It is not probable that it will spread to any great extent beyond the limits now occupied, for it has long since filled all suitable localities. Here and there the opening up of limited areas of forest may by change of conditions allow it to colonize these, but the great bulk of the forest is now reserved and not likely to be opened up. There is no reason to suppose that the endemic insect fauna will suffer any considerable further diminu-

tion, and it may, so far as one can see, remain as it is for ages to come. The chief danger would be in the introduction of some predaceous creature like *Pheidole*, which would be able to occupy the great area of forest land and the country above this, where *Pheidole* does not now exist. As no such insect has been imported in the course of the last century, it is on the whole improbable that it ever will be."

And, further, in discussing the ant fauna of the islands, the author adds:

"*Pheidole megacephala* is the most abundant of all the foreign ants. In many parts it occupies not only the whole open country, but also the forests to a height of about 2,000 feet in the mountains. In open country it sometimes becomes established as high as 4,000 feet, and may be numerous at three thousand. Usually, where forests are dense, it ceases to range above about 1,200 to 1,500 feet of elevation, while in its range, no matter how fine or how dense the forest may be, the endemic fauna, save for a few forms, that can resist, or are tolerated by the ants, is entirely exterminated. This native fauna, especially of beetles, appears as if by magic, the moment the limit of range of *Pheidole* is reached. . . . Of the native insects that are attacked by *Pheidole*, the Aculeate Hymenoptera are the least injured. Even in the case of large Crabronids and wasps of the genus *Odynerus* it is common enough to find specimens with one or more workers of *Pheidole*, or with the great head of the soldier-form attached to their legs or antennae, and we have noticed instances where these strong insects have been entirely overcome by their assailants."

1914. Illingworth, J. F.—Further notes on the breeding of the Tachinid fly parasite on the cane beetle borer. Journ. Econ. Ent. VII, 396.

The writer places the small brown ant (*P. megacephala*), at the head of the list of mortal enemies of the flies. These ants were troublesome at every stage of the breeding work; being on the ground about the cages in myriads, they swarmed inside at the least opportunity. Carbon bisulphide was used effectively for the destruction of nests in the cages.

Emerging flies in the field were often observed in the toils—a single ant, at this time, being able to hold a fly, and the cane is always swarming with them.

The larvae of the flies only escape because the parasitized borers plug the channels behind them and build ant-proof cocoons, for the ants quickly destroy both grubs and maggots when exposed.

1915. Ehrhorn, E. M.—Ants. Report of the Division of Entomology for the biennial period ending December 31st, 1914. Hawaii Bd. Agric. and Forestry, p. 139-140.

The author reports *Pheidole megacephala* as giving much trouble to householders, attacking foods, but states that this species is more of a garden pest. He says that they frequently loosen the soil around young plants, causing them to fall over, and that they are more troublesome in dry situations.

Control measures include placing the legs of tables, etc., in dishes of water, or tying bands soaked in ant-poison about the legs, and the destruction of the nests. Since this species nests in the soil, outside of the building, they are easily killed by the use of gasoline or carbon bisulphide.

1915. Girault, A. A.—*Pheidole megacephala* Fab. dying from cold in North Queensland. Ent. News, XXVI, 362.

This interesting note follows:

“Toward the last week of July, 1912, all over the Goondi, Darradgee and Mundoo cane plantations near Innisfail, I saw little heaps of dead ants, each heap containing several hundred specimens of the workers and soldiers. They were rather common and I was considerably puzzled to account for them until chancing to hear from a farmer that young sugar cane had been slightly damaged by recent frosts; the ants doubtless had suffered from the same cause, the more clearly indicated because the species appears to be an equatorial one or one of the uplands or of situations not exposed to cold spells in the tropical sense. Nests adjoining the heaps of dead contained living individuals acting as usual. Later, on August 8, at Nelson, North Queensland, I found the same species, dead in similar heaps; if along a road, these heaps all seemed to be

in the wheel ruts; from their appearance, they were several weeks or more old."

1915. a. Illingworth, J. F.—Coconut leaf-roller [*Omioides blackburni* (Butl.)] destroyed by ants. Proc. Haw. Ent. Soc. III, 142.

P. megacephala destroyed both the egg-masses and the caterpillars of the above pest, in Palolo Valley, so successfully that no pupae resulted. The ants first cut away the under-part of the web, that protects the young caterpillars, and then pulled them out.

1915. b. Illingworth, J. F.—Notes on the hen flea (*Echinophaga gallinacea* Westw.). Proc. Haw. Ent. Soc. III, 252.

The ants were observed removing the larvae of the fleas from the dust of the roosting-board.

1915. Muir, F.—Review of the autochthonous genera of Hawaiian Delphacidae. Proc. Haw. Ent. Soc. III, 180 and 203.

The author attributes the absence of Delphacids from a certain food-plant, that contained numerous unparasitized-eggs, but no nymphs or adults, to the numerous ants (*P. megacephala*), which swarmed over the plant.

On page 203, in discussing the death factors of Delphacids, the author says: "At the present time the introduced ant (*Pheidole megacephala*) plays a very important part in the districts in which it can thrive, and it is likely it will lead to the extinction of certain species."